THE HAND-BOOK

OF

PHOTOGRAPHIC TERMS.

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PHOTOGRAPHIC TERMS,

AN ALPHABETICAL ARRANGEMENT OF THE PROCESSES, FORMULÆ,
APPLICATIONS, ETC., OF PHOTOGRAPHY,
FOR READY REFERENCE.

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ABERRATION (*Lat.*) A term employed in optics to designate the unequal deviation of rays of light when refracted by a lens, or reflected from a concave mirror. There are two kinds of aberration, viz. :—

ABERRATION, CHROMATIC (*Gr.*) arises from the different degrees of refraction which the rays composing a beam of light undergo in passing from one medium into another. On account of this difference of refrangibility, the rays of light are separated, and the colours of the spectrum appear. This fault is avoided by combining substances of different refractive powers, as, for example, crown and flint glass in the same lens. *See* DISPERSION.

ABERRATION, SPHERICAL, is the deviation of the rays of light from the true focus of a curved lens, in consequence of which they do not unite in a single point (the marginal rays having a shorter focus than the central rays), but are spread over on a small surface and form a somewhat confused image of the object. This arises from two causes:—first, the figures of the lenses; and, secondly, from a difference in the physical nature of the rays of light. This is exhibited in the photographic camera by the impossibility of getting "sharpness" over the whole field of the ground glass. The centre of the picture being in focus, the marginal rays will form a circle of diffusion which gives a blurred appearance to the picture. The fault is lessened by using diaphragms or "stops" *q.v.*, and by lengthening the focus.

ABSORPTION — ABSORBITION (*Lat.*) Swallowing or sucking up.

ACCELERATOR (*Lat.*) A name often applied to any substance which shortens the time of exposure, either in the camera or in the printing-frame, and in the developing of the exposed plate.

ACCESSARY or ACCESSORY (*Fr.*) In the Fine Arts, is a term which extends to everything introduced into a work that is not absolutely necessary. Especial care is to be taken that they be so selected and disposed as not to interfere with the principal interest. In photography, commonly, the term is applied to backgrounds, furniture, and imitation objects of nature, introduced to give motive to the picture. Great skill and discrimination are necessary for their use, as they often destroy rather than add to the interest of the work. *For exteriors*, rocks, stumps, shrubbery, gateways, &c., may be introduced with good effect, but the great danger is of overdoing it, and heaping together a lot of incongruous objects. The background must be scenic, or suggestive of the open air. *For interiors*, there is greater variety, and also greater temptation to overcrowd. Chairs, tables, statuettes, pictures, curtains, hassocks, &c., will be found effective if introduced judiciously. *The posing chair*, or high-backed chair, is an extremely useful accessory, but generally abused. In making the pose of a figure leaning on it, see that the leaning attitude is only *suggested*, otherwise stooping is induced, awkward lines introduced, and, in the

case of bare arms, total loss of contour. *The curtain* of repp or silk is a most graceful and useful accessory. By it, many beautiful lines may be introduced into a composition, and it is also serviceable in hiding and breaking up ugly lines, and for hiding the lower portion of the head-rest.

ACETATES. Certain neutral salts formed by the combination of acetic acid with a salifiable base.

ACETATE OF LEAD, ETC. *See* LEAD, ETC., ACETATE.

ACETATE OF MORPHINE DRY PLATES. *See* DRY PLATE PROCESSES.

ACETATE OF SILVER. *See* NEGATIVE BATH.

ACETIC ACID. $C_2H_4O_2$. A colourless liquid of very pungent odour. Boils at 246° Fahr., the vapour being inflammable. Dissolves in water, alcohol, and ether. The strongest acid contains only a single atom of water, and owes the title of "glacial" to its property of solidifying at a moderately low temperature. By some is used a cheaper form of acetic acid, known as "Beaufoy's Acid," which should be of the strength of the acetic acid fortiss. of the London Pharmacopæia, containing 30 per cent. of real acid. In making up formulæ where the glacial acetic acid is mentioned, three times the quantity should be added of Beaufoy's acid. Principally used in the developer.

ACETIC ACID, ACTION OF, IN DEVELOPMENT. Acetic Acid exercises a moderating influence over the developing solution of iron, restraining the violence of its action, and preserving the purity of those parts of the iodide which have not been affected, or but slightly touched, by light. It has also the advantage of causing the solution to flow easily over the film, thus forming a substitute for alcohol, which would otherwise be required, to prevent greasiness or streaks. The quantity of acetic acid used in the developer varies in the practice of almost every operator, and under ever-changing conditions of the bath. The exercise of care and thought will best guide the operator in this. *See* DEVELOPER.

ACETIC ETHER. *See* ETHER, ACETIC.

ACETOMETER. An apparatus used in determining the strength of acids.

ACETO-NITRATE OF SILVER BATH. *See* PRINTING BY DEVELOPMENT.

ACHROMATIC. (*Gr.*) Possessing the quality of freeing from colour; hence a lens or combination of lenses is said to be achromatic when the image is seen through it, free from any coloured fringes round its edges.

ACHROMATISM. The term applied to the phenomenon of the refraction of light without decomposition. The destruction of the coloured fringes which accompany the image of an object seen through a prism or lens.

ACICULAR (*Lat.*) Fine like a needle.

ACID (*Lat.*) In common language, any *sour* substance, but in chemistry the term is less restricted, being often applied to substances which saturate and neutralize the alkalies, and other salifiable bases, without other obvious acid properties.

ACID, ADDITION OF, TO BATHS. *See* ADDITION OF, ETC.

ACID CONDITION OF NITRATE OF SILVER. It is usually found that a solution prepared from the commercial nitrate of silver has an acid reaction, the crystals having been imperfectly drained from the acid mother liquor in which they were formed. It is therefore very necessary to note the condition of the new bath, that acid be not added unless it is required. For the purpose of testing for acid, litmus paper is used. The bath solution may become more acid by continued use, if collodion containing much free iodine be constantly employed.

ACID PRINTING BATH. *See* PRINTING BATH.

ACIDS, EFFECT OF, IN DEVELOPMENT. Acids exercise a retarding effect upon the reduction of salts of silver by the developing agents. The solution of protosulphate of iron alone

operates too rapidly; but if a little acetic acid be previously added, the precipitation is more gradual, and the operation can be more readily watched by the operator. When bath and developer are strongly acidified, the precipitation of silver on the plate is for a time suspended. On the other hand, *alkaline* liquids produce an opposite effect, and favour rapid reduction. *See* DEVELOPER.

ACTINIC (*Gr.*) A lens is sometimes styled actinic when a number of those coloured rays which exert a chemical action on the sensitive photographic plate are combined with sufficient of the luminous rays to render the image visible.

ACTINIC FOCUS OF LENS, TO FIND THE. Place a strip of printed paper in front of the lens, in a position slightly away from the parallel; then, focusing sharply on the centre letters on the paper, take a negative. If the negative is "sharpest" at the point focussed, the actinic correction is perfect. If not, carefully examine the negative to find whether the letters nearer or farther from the centre are in focus, on which the ground glass of the camera must be set forward or back, as the case may be.

ACTINIC STATE OF THE ATMOSPHERE. Even to the eye of experience it is extremely difficult to correctly determine the actinic power of the light. It would appear natural to infer that those days when the sun's rays are most brilliant would be best for rapid impression of the sensitized plate; but experience teaches us such is not always the case. If the light be of a yellow cast, however bright it may be, its actinic power will be weak and poor. Towards the evening it will often be observed that a sudden diminution of sensibility in the plate is perceptible, when but little difference in the brilliancy of the light is to be detected. The sun sinks in a golden blaze, and all chemical action is soon at an end; hence the difficulty of obtaining photographs in the glowing light of tropical climates; the superiority of the spring over the mid-summer months; of the light of the morning over that of the afternoon, &c. A clear atmosphere, with light fleecy clouds moving before a gentle breeze, are generally found to be the conditions of the highest power of the light; and a cloudless sky with haze in the distance are indications of the opposite kind.

ACTINISM (*Gr.*) That property of the sun's rays which effects chemical combinations and decompositions in the processes of photography, in contradistinction to their heating and illuminating powers.

ACTINOGRAPH. An instrument for measuring the chemical action of the sun's rays.

ADAMANTEAN. The style of a ferrotype plate largely used. Manufactured by the Messrs. Anthony, of New York.

ADAMANTINE SPAR, also known as *Corundum*, from its extreme hardness is used for grinding the edges of glass plates, for which purpose files are sold at the photographic stock houses.

ADDITION OF ACID or AMMONIA TO BATH SOLUTIONS. In the operations of rendering bath solutions acid or alkaline the greatest care should always be exercised. Pure nitric acid should *never* be used to acidify an alkaline solution; nor should even the comparatively weak ammonia, known as "liquor ammoniæ," be used undiluted. Both acid and ammonia should be first diluted, one drop to twelve drops of water, and the solution carefully added in drops. The bath solution after each addition should be well stirred and tested.

ADHESION (*Lat.*) The force with which particles of dissimilar bodies remain attached to each other when they are brought into contact. Opposed to the term COHESION.

AERIEL (*Lat.*) A term used in art to express the effect of remoteness in a scene. The longer the column of air through which an object is seen, the less forcibly do the visual rays emitted from it strike the eye.

ÆSTHETICS. *See* ESTHETICS.

AFFINITY, CHEMICAL. The attractive force by which dissimilar sub-

stances combine with each other to produce chemical compounds. *See* ATOMIC WEIGHT.

Ag. The chemical symbol of Silver (Argentum).

AGATE BURNISHER. When plain paper prints are "mealy" and deficient in vigour, it is thought by some an improvement to impart a smoothness and glaze to the surface; this may be done by rubbing over with a polished piece of agate, the print being placed, face upwards, on a sheet of plate glass or other hard polished surface. This and other hand-burnishers have given place to burnisher presses.

AGENT (*Lat.*) That which has the power of operating or producing effects upon another thing.

AGGLUTINATE (*Lat.*) Unite as with glue.

Al. The chemical symbol of Aluminium.

ALABASTRINE POSITIVES. *See* POSITIVE PROCESS.

ALBUM (*Lat.*) Literally means anything white. The album of the Prætor (Roman Consul) was a white board on which his edicts were inscribed. The term is now generally applied to books used for the reception of scraps, autographs, and photographs, so that they may be examined without being injured, which find their place in every house.

ALBUMEN. A peculiar organic principle entering largely into the composition of animal bodies. It is also the chief component of the white of egg, to which in photography the term is generally applied. It is soluble in cold water, and decomposes quickly.

ALBUMEN IN THE NITRATE PRINTING BATH. Albumen dissolved from the albumenized paper and other impurities causes the bath to turn brown. The bath so contaminated may be restored by the addition of kaolin, *q.v.*, or permanganate of potash, *q.v.*, and being placed in the sun. More efficacious treatment may be found in boiling, &c. *See* PRINTING BATH, TO RESTORE.

ALBUMENIZING GLASS PLATES. A process taking the place of the old tedious method of cleaning plates by polishing. Into a bottle containing (say) 20 ounces of water, place the white of one egg, the germ being extracted. This is well shaken up, splinters of broken glass placed in the bottle accelerating the solution of the albumen, which will be perfect in ten or twelve minutes. Add a few drops of ammonia, and filter quite clear. The glass plate, if new, should be first placed in a dish of pure nitric acid for a few hours, rinsed under a tap of clear water, and then coated (as with collodion, varnish, &c.) with the albumen, on one side only; then stood in a rack to dry, in a place free from dust. With old *used* glass the process is exactly the same, except that care must be taken to perfectly remove the old film. For this purpose the plate is first placed in a dish of concentrated potash solution until the film floats off; it is then placed in the nitric acid for at least twenty-four hours, washed, and coated with albumen. When the albumen is perfectly dry, the plates may be placed and kept together ready for use. *Preserve from damp.*

ALBUMENIZED PLATES, DEFECTS IN. 1. Failure is sure to ensue on albumenizing imperfectly cleansed glass. 2. *Slipping of the film*, generally may be attributed to the mistake of collodionizing the unalbumenized side of the glass. Place them in a rack on an uniform plan. 3. *Slipping of the film* may be caused by greasiness of the glass plate, imperfectly cleaned, on albumenizing. The greasy plate should be placed in the potash dish for a few hours, and thoroughly washed under the tap. 4. *Glossy silvery stain* appearing under the collodion film is another evidence of imperfect cleaning of the plate, especially where old glass, which has been used before, is albumenized. The stain is especially noticeable from the back of the negative. Return the glass to the potash solution—or, what is safer, discard it. 5. *Dirty edges and spots proceeding therefrom* are caused by resting the wet plate on a dirty place. The

rack on which they are drained, after being albumenized — dirty shelf — or *dirty fingers* of the albumenizer— which? 6. *Irregular spots and short lines* are caused by dust and fibre falling on the wet plate. 7. *A host of defects* arise from imperfectly filtered albumen solution—and dirty washing water. *With ordinary care* the process of albumenizing plates is easy, clean, and thoroughly certain; but want of care is fatal to success. Wipe shelves, table, and rack with a damp cloth, and sprinkle the floor of the room.

ALBUMENIZED PAPER. Paper which has been covered with a coating of salted albumen, used in the printing processes in combination with nitrate of silver. The albumen gives the surface of the paper a finer finish and greater brilliancy, and variety of tone to the prints, and the detail of the negative with extreme sharpness and great transparency in the shadows. On the other hand, the glazed surface is objected to by artists as vulgar and inartistic. *See* PLAIN PAPER. The difficulties of preparation in small quantities, and the excellence and cheapness of the commercial samples, make it advisable to purchase, rather than prepare, albumenized paper.

ALBUMENIZED PAPER, DEFECTS IN. Sometimes, though not so often as photographers would *wish* to believe, there are faults in the commercial albumenized paper. These may generally be found on examination; those discovered *after* printing may generally be ascribed to faults of manipulation. (*a*). *Unequal albumenizing* will make itself apparent by the difference of quality and brilliancy of the prints from one sheet of paper, treated in the same manner, and printed from one negative, or negatives of the same quality. (*b*). *Dry and horny paper* should be kept in a cool, damp place before silvering. (*c*). *Tear drops* are often the evidences of above fault. To save the paper on which they appear, blot them off. The use of the glass rod, over which each sensitized sheet should be drawn, will greatly remedy the defect. *See* SENSITIZING THE PAPER. (*d*). *Albumen spots and streaks* are evidences of carelessness in albumenizing the paper. (*e*). *Metallic spots* are sometimes caused in the drying room of the albumenizer, and, as often as not, in that of the printer. They are the effect of rust particles from the stove, &c.

ALBUMENIZED PAPER, PRINTING ON. *See* PRINTING.

ALBUMINATE OF SILVER. *See* SILVER ALBUMINATE.

ALCOHOL (*Arab.*) C_2H_6O. Obtained by the careful distillation of any spirituous or fermented liquors. If wine or beer be placed in a retort, and heat applied, the alcohol, being more volatile than water, rises first, and may be condensed in an appropriate receiver; a portion of the vapour of water, however, passes over with the alcohol, diluting it to a certain extent, forming what is known as "spirits of wine." Much of this water may be removed by redistillation from carbonate of potash: but in order to render the alcohol thoroughly anhydrous, it is necessary to employ quicklime, which possesses still greater attraction for water. Pure anhydrous or absolute alcohol is a limpid liquid of agreeable odour and pungent taste, sp. gr. at 60°, ·794, absorbs vapour of water, and becomes diluted by exposure to damp air; boils at 173°. Has never been frozen. Alcohol distilled from carbonate of potash has a sp. gr. ·815 to ·823, contains 90 to 93 per cent. of real spirit. Rectified spirits of wine, sp. gr. about ·836, contains 80 to 83 per cent. of absolute alcohol. It is very suitable for use in the developer, but is not sufficiently strong for good collodion. Methylated spirits of wine contains 10 per cent. of wood naphtha; is often very inferior in quality, and scarcely to be relied upon for use in photography.

ALCOHOL, EFFECT OF, IN COLLODION. Generally used in equal proportion with ether for the solution of pyroxyline; it is favourable to intensity of the image, and counteracts

the tendency to toughness of the film shown by a collodion in which an excess of ether exists. Too great an excess of alcohol renders the collodion rotten; the film is easily torn, having little coherency, especially when the alcohol contains water. Preventing rapid evaporation of the ether, the use of an excess of alcohol is often advantageous in hot weather. Another advantage of making the collodion with a large proportion of alcohol is that the film is more easily made wet by the bath solution, and does not repel the liquid in greasy lines upon the film surface; especially useful when coating large plates.

ALCOHOL, USE OF, IN THE DEVELOPER. With a new, pure sensitizing bath, addition of alcohol to the developer is not recommended in the first place, as its effect is to reduce the intensity of the negative, and to give coarseness to the image; but on days when the actinic principle is slow, and the image develops with too much intensity, the addition of alcohol has a beneficial effect. When, from age of the nitrate bath, and its accumulation of alcohol and ether, the developing solution flows over the sensitized film as on a greasy surface, and causes stains and streaks from unequal development, the addition of a small quantity of alcohol is advantageous. *See* DEVELOPER.

ALDEHYDE (from *al*-cohol *dehyd* rogenatum). A pungent volatile liquid obtained by distilling alcohol with oxide of manganese and sulphuric acid.

ALKALI, or ALCALI (derived from the Arabic article *al*, and *kali*, the name of a plant in the same language). A term originally applied to the ashes of plants; now generally used to designate potash, soda, and ammonia, which are also termed vegetable, mineral, and volatile alkali. These substances have certain properties in common; such as neutralizing and forming salts with the acids, reddening several vegetable yellows, and changing some blues to green; and ready solubility in water. The alkalis and alkaline earths exhibit all the true characteristics of bases in perfection, viz., causticity and corrosiveness, and the power of uniting with another class of compounds—the acids, equally caustic and corrosive, and of producing compounds comparatively inactive and harmless. They possess also the property of changing the red of litmus to blue, and the yellow of turmeric to brown.

ALKALINE, in a general sense, is applied to such things as have the properties of an alkali.

ALKALINE DEVELOPMENT. A term used to describe development where the reducing agent is alkaline. With several of the dry-plate processes the developer used is pyrogallic acid and ammonia.

ALKALINE GOLD TONING BATH. *See* TONING BATH.

ALKALINE NEGATIVE BATH. *See* NEGATIVE BATH.

ALMOND OIL. A drying oil, colourless as water, very useful for rendering paper or paper negatives semi-transparent. The paper should be steeped in the oil for several hours, then wiped and hung up to dry. Should the oil be too thick it may be thinned by the addition of benzole.

ALLOTROPIC (*Gr.*) Identity of composition combined with difference of qualities. When a substance exists in two or more forms having different properties, but still chemically the same, as albumen in the liquid and in the coagulated state, the unusual form is said to be allotropic. Light produces this effect on some bodies and certain temperatures on others.

ALUM (*Lat.*) Used sometimes in the positive sensitizing bath to give the paper brilliancy and keeping qualities.

AMBER (*Fr. Ital.*) A fossil gum-resin used in varnish *q.v.*

AMBER VARNISH. *See* VARNISH.

AMBIENT (*Lat.*) Encompassing; surrounding. A term applied to such bodies, especially fluids, as encompass others on all sides; thus, the air is fre-

quently called an ambient fluid, in consequence of being diffused round all terrestrial bodies.

AMBROTYPE. Collodion positives are so called in America.

AMMONIA. NH_3 (*volatile alkali*). Pure ammonia is obtained by heating a mixture of quicklime and muriate of ammonia. It has a very pungent odour, and is so soluble that one measure of water absorbs nearly 700 of gaseous ammonia. This solution is known under the name of *liquor ammoniæ*. It possesses those qualities which are termed alkaline, but differs in an important particular from the other alkalis—it is volatile. Solution of ammonia rapidly absorbs carbonic acid from the air, and is converted into carbonate of ammonia. It should, therefore, be carefully preserved in stoppered bottles. The strength of commercial ammonia varies greatly ; that sold for pharmaceutical purposes under the name of liquor ammoniæ contains about ten per cent. of real ammonia.

AMMONIA, ADDITION OF, TO BATHS. *See* ADDITION OF ACID, ETC., TO.

AMMONIA CARBONATE. Obtained by sublimation. Its composition is rather variable ; when first formed it has nearly the composition of a sesquicarbonate ; but by exposure to the air, neutral carbonate of ammonia escapes, and a white powder is left, which is a bi-carbonate.

AMMONIA, FUMING WITH. *See* FUMING.

AMMONIA HYPOSULPHATE. NH_4SHS. A double sulphide of hydrogen and ammonium is formed by passing sulphuretted hydrogen gas into ammonia. Hydrosulphate of ammonia is employed in photography to darken the collodion image, and is also a test for the presence of silver in certain solutions.

AMMONIA NITRATE. NH_4NO_3. A neutral combination of Nitric Acid and Ammonia, which may be crystallized without difficulty. It is gradually formed in the nitrate of silver bath when compounds of ammonium are used in iodizing.

AMMONIO-CITRATE OF IRON. *See* IRON AMMONIO-CITRATE.

AMMONIO-NITRATE OF SILVER. *See* SILVER AMMONIO-NITRATE.

AMMONIUM. NH_4. A hypothetical metal, supposed to exist in ammoniacal salts.

AMMONIUM BROMIDE. NH_4, Br. A crystallized salt, which may be prepared by precipitating Bromide of Calcium by Carbonate of Ammonia. Very soluble in water, and more easily dissolved by alcohol and ether than the corresponding bromide of potassium, and does not become coloured on keeping like the iodide of ammonium. It is a better form of bromide for collodion than the corresponding salt of potassium or cadmium, and can usually be obtained in a pure state.

AMMONIUM CHLORIDE. NH_4Cl (*also known as muriate or hydrochlorate of ammonia*). Occurs in commerce in the form of colourless and translucent masses, which are procured by sublimation, the dry salt being volatile when strongly heated. It dissolves in equal parts of boiling, or in three parts of cold water.

AMMONIUM IODIDE. NH_4I. Usually sold in small crystals more or less of a yellow colour. An unstable substance, and prone to liberation of iodine ; but if thoroughly dried and carefully kept from light, may be preserved for an unlimited length of time. More soluble in alcohol than iodide of potassium, and is not precipitated on the addition of ether. Also soluble to a large extent in water—alkaline reaction to litmus-paper. In the commercial iodide of ammonium are often found sulphate of ammonia, and sometimes carbonate of ammonia introduced for the purpose of preserving the iodide in a colourless condition. To decolourize iodide of ammonium which has been decomposed by keeping, shake it up with a little ether, pure or methylated ; the iodine will be dissolved out, and unless alcohol be present, no great loss from solution will result.

AMMONIUM SULPHOCYANIDE. NH_4S_2Cy

Has been proposed as a substitute for hyposulphite of soda in fixing positive prints. From its greater expense and other causes its use has not been adopted.

AMORPHOUS (*Gr.*) The term applied to those substances which do not crystallize in a definite form.

AMPHITYPE (*Gr.*) A process in which light produces a positive and negative in one picture. A sheet of paper is prepared with a solution, either of ferro-tartrate or ferro-citrate of protoxide, or peroxide of mercury, and then with a solution of ammonio-tartrate or ammonio-citrate of iron, the latter being in excess. Exposed in the camera, a negative is produced which gradually fades in the dark, but may be restored as a black *positive* by immersion in a solution of nitrate of mercury, and ironing with a very hot iron.

ANGULAR APERTURE. A term applied to lenses to denote the angle or space included between two lines diverging from the focal point, and bounding all the light which passes centrally through the aperture of the lens; it is, therefore, the measure of the amount, or intensity of the light passing through the apertures of the lens as concentrated at the focal point.

ANGLE OF FIELD of a lens, or in other words, the angle of view embraced, is the extent of surface, or area, illuminated by a lens.

ANHYDRIDES (*Gr.*) Bodies without water. A chemical term restricted to the anhydrous acids, or acids without water.

ANHYDROUS (*Gr.*) Without water. A term applied to salts, and to acids when deprived of water.

ANILINE, or AMIDO-BENZENE—C_6H_5 (NH_2^-). This important body is benzine, in which one atom of hydrogen is replaced by the nomad group (NH); and therefore it is properly called amido-benzene. Aniline is a colourless liquid possessing a peculiar smell; its specific gravity at 0° is 1·036, and it boils at 181°. It is nearly insoluble in water, but dissolves in alcohol and ether; it unites with acids to form definite salts, but does not turn red litmus paper blue. Aniline is remarkable for the beautiful colours which may be formed from it. With chromic acid it gives a dark green or bluish black colour which has been taken advantage of in photography.

ANILINE PROCESS. An old process in which the print was developed by means of aniline and benzole. The paper on which the print is to be made is treated to a solution composed of bichromate of ammonia or potash, 30 grains; phosphoric acid, 1 fluid drachm; water, 1 fluid ounce, evenly brushed over with a broad camel's-hair pencil or tuft of wool. Dried in the dark. Printed under the negative about one-fourth the required time for a silver print, and developed by placing the print face downwards over a tray (the bottom being covered with bibulous paper), containing one drachm of commercial aniline, thoroughly mixed with two ounces of benzole. Wash for two or three minutes. V. P.A '85 ב10

ANIMAL CHARCOAL. The product obtained by the carbonization of bones, horn, muscle, and other animal matters; distinguished from vegetable charcoal by its lustre and sponginess. Sometimes used in photography to remove colour and organic impurities from nitrate of silver, but from its impurities it is not so safe to use as kaolin, *q.v.*

ANIMAL OIL OF DIPPEL. Rectified oil of hartshorn; it has been used as a solvent of bitumen.

ANIMALS, PHOTOGRAPHING. In this most difficult branch of photography, great patience and skill are necessary. *Horses* should be photographed in bright sunlight. Secure a neutral background in some object behind. Be careful to give prominence to the fine "points" of the animal. Place the camera in such a position that all the legs of the animal are seen, and rather nearer the tail than the head. See

that the image is perpendicular on the ground glass. It is best to have the horse gently exercised for a few minutes before the time of exposure. Various expedients are resorted to to secure attention, as the playing of a musical instrument, blowing a horn or bugle, sometimes leading out a strange horse, a boy running, or noises made by the operator will serve to arrest the attention of the restive animal sufficiently long for the exposure of the plate. *Sporting Dogs* may be best photographed after a walk, when they are generally most steady. A man (out of sight) blowing a horn will often secure the attention of the dogs, and their attitudes will be spirited and natural. Sometimes the crack of a whip has the desired effect. A dog's attention may sometimes be caught by hearing the imitation of a cat's cry. *Goats*, *Cows*, *Sheep*, &c., are often to be quieted by low, soft music, or the tinkle of a bell kept out of sight. Other "small deer," as *Poultry and Ducks*, may be caught with such "chaff" as a loud imitation of a cock-crow or "quack." General expedients, such as the waving of paper, rattling a stick, a loud clockwork wheel, &c., serve at times.

ANIMAL SUBSTANCES used in photography are albumen, gelatine, glutin, isinglass, and a few others; they are of service in forming transparent films, and in combination with silver compounds for the production of images.

APPARATUS, CARE OF. The greatest care in the use of all photographic apparatus should be exercised. Daily dusting of cameras, cleaning of holders, developing utensils, &c., are necessary for the avoidance of failure in the manipulations. Bottles should be thoroughly washed out when empty, and not left till required for use. This care saves not only many annoying accidents (?), but apparatus, &c., will, under such treatment, last longer and prove more satisfactory than that subjected to neglect and rough usage. *See* CLEANING BOTTLES, ETC.

APLANATIC. A term applied to that kind of refraction which completely corrects the aberration of the rays of light, and the colour depending thereon; in contradistinction to achromatic, in which there is only a partial correction of colour.

APLANATIC LENS. A lens such that rays parallel to its axis, or rays diverging from a point in its axis after passing through it, and suffering refraction at its surfaces, converge to a single point or the true focus. In order, therefore, to be aplanatic, the lens must not only have the true geometrical figure necessary to destroy aberration, but must also be constructed of different media, so as to correct the effects of the unequal refrangibility of the different rays—that is to say, it must be achromatic. Neither of these conditions can be accurately fulfilled in practice; the object aimed at is therefore to give the lens such a form that, with the given index of refraction, the aberration shall be the least possible.

APOTHECARIES WEIGHT. *See* WEIGHTS AND MEASURES.

AQUA (*Lat.*) Water.

AQUA FORTIS (*Lat.*) Nitric acid, *q.v.*

AQUA REGIA. Nitro-hydrochloric acid, *q.v.*

AQUA-TINT. A term used to describe a granulated condition of metal plates used in the various photographic engraving processes, produced by finely-powdered resin sprinkled over the surface and heated, becoming melted and forming a net-work over the whole surface.

ARGENTITE (*Lat.*) A name for sulphite of silver or silver glance.

ARGENTOMETER (*Lat.*) A graduated tube used for ascertaining the amount of silver in a solution.

ARGENTUM (*Lat.*) Silver, *q.v.*

ARRANGEMENT (*Fr.*) In art, the putting in proper order the objects of a picture to carry out the motive of the work; and the disposition of lights and darks in accordance with the laws of art.

ARROWROOT. The common name for the starch derived from the tubers of the *Maranta arundinacea*. In its pure form it constitutes an excellent subsidiary sizing for photographic papers, giving a most beautiful surface.

ARSENIC. As. 74·9. Sometimes found in a free state, but more frequently combined, chiefly with iron, nickel, cobalt, and sulphur.

ARSENIC BROMIDE. As Br_3. Has sometimes been used in collodion for increasing the intensity of the developed image.

ART (*Lat.*) The application of power or knowledge to effect a desired purpose. The ancients divided the arts into "artes ingenuæ," "bonæ," or "liberales," and "artes serviles." Under the latter were comprehended the mechanical arts, because they were practised only by slaves. In modern times the arts are divided into fine and useful, under both of which distinctions photography should take an honourable position.

ARTIST. The professor of an art. One who, by careful study, has attained the knowledge of what is picturesque and beautiful, and the causes which produce these qualities, and is able to give expression to them in his work—the various effects and character of form, light and shade, and colour, and the manner in which they should be arranged and combined to form a work of art.

ARTISTIC. After the manner of an artist; or of the character of a work of art.

ARTIFICIAL LIGHT. Various experiments have been tried to produce light in the photographic studio for the negative and printing processes, and in some cases with considerable success, save in the one important item of cost. It may be noted that both the electric light and that produced by the combustion of pyrotechnic mixtures, with parabolic and other reflectors, and screens for the diffusion of the light, were patented over a quarter of a century ago. *The Electric Light*, produced by a powerful electro-dynamic machine driven by a steam or gas engine. The apparatus needed to produce a light suitable for portraiture is so expensive as to be a bar to its general use. *Magnesium Wire*, when burnt in air or in oxygen, emits a most dazzling white light, strongly actinic; the chief difficulty being to ensure the production of a regular and constant flame. *Drummond Light*. A burning jet of mixed oxygen and hydrogen gases impinged on a ball of lime produces a most intense light. Used in printing, but principally for the exhibition of dissolving views, &c. *Oxy-calcium Light*, produced by passing a jet of oxygen into the flame of a spirit lamp, and directing the flame upon a ball of lime. *The Combustion of Coal*, promoted by oxygen gas, was one of the first artificial lights used for portraiture. *Common Gas Burners* and oil lamps have been used in photo-micrography, in dry plate printing, and for other photographic purposes. *Various Pyrotechnic Compositions* have been employed for producing, by their rapid combustion, an intense actinic light, but the fumes are with difficulty carried off. *Vanderweyde's* system of lighting, now in successful operation at his gallery, embraces "the employment, in combination with the electric and other artificial lights, of a parabolic or other concave reflector of comparatively large size, in the focus of which the light is placed, and a screen of opaque or semi-translucent material placed on the opposite side of the light to the reflector." *The Luxo-graph* system, now in use, also employs the electric and other artificial lights, the reflector, the semi-transparent screen for the diffusion of the light, &c. The placing of the light in a parabolic reflector is a requisite in artificial lighting.

"ARTOTYPE" (OBERNETTER) PROCESS. The title of an American process of permanent printing, from ordinary negatives, in printers' ink, on a hand press, with "either matt, grained,

or enamelled surfaces, and in any desired tone or colour, or in various colours." The process is based on the action of bichromated gelatine under the influence of light, whereby certain portions of the film are rendered insoluble or waterproof, and other portions partially so, by which the shadows and half-tones are built up, and a printing matrix formed. The exposed plate being steeped in water, some parts of it, where light has not acted, will absorb the water, and other parts, where light has acted, will refuse to do so. Grease rubbed over the plate touches only those parts of the plate which are non-absorbent of water, or, in other words, have been acted upon by light. The ink used being lithographic, which is simply grease to which a colouring matter has been added, acts only on the greasy surface, and has no influence on the water-charged portions of the film.

As. The chemical symbol of Arsenic.

ASPHALT, ASPHALTUM, or BITUMEN OF JUDÆA. An indurated pitch, first found on the shores of the Dead Sea, in Judæa, hence its name. Now more abundantly found in Texas, Trinidad, Barbadoes, and other places. Somewhat heavier than water, easily melted, and very inflammable. May be purified by boiling in water, when the pure asphalt floats on the surface, while the impurities subside; by the action of hydrochloric acid; and by oil of turpentine.

ASPHALT DISHES. Wooden boxes made water-tight with asphaltum are sometimes used for photographic purposes.

ASPHALTOTYPE. A process invented by Nicephore Niepce, of which, as the name indicates, asphaltum was the basis.

ASPHALTO - PHOTO - LITHOGRAPHIC PROCESS. Another asphalte process of Niepce's.

"AT HOME" PORTRAITS. The style of a new picture introduced by Mr. Samuel A. Walker, of Regent Street. As the title expresses, the sitter is photographed at home, in some favourite apartment, and surrounded by objects familiar and dear by association. The artistic feeling and manipulative skill exhibited by Mr. Walker give earnest that difficulties of lighting may be borne down; and it may safely be said that the portrait at home bids fair to become an extremely popular picture.

ATOM (*Gr.*) A part so small as not to be divisible.

ATOMIC WEIGHT. When substances combine chemically they are found to unite in certain weights. Thus water is constituted of one part by weight of hydrogen and eight of oxygen, and the gases only combine in these proportions to form it. It is assumed that water is composed of an atom of hydrogen and an atom of oxygen, and that the relative weight of the atom of hydrogen to the atom of oxygen is as 1 to 8; hence the atomic weight of water is $1 + 8$ or $= 9$.

ATOMIC WEIGHTS, TABLE OF. *See* VOCABULARY OF PHOTOGRAPHIC CHEMICALS.

ASTIGMATION (*Gr.*) An error in lenses in which, to secure great flatness of field, the defining power of the lens, as regards the oblique pencils, is injured.

ASTRO-PHOTOGRAPHY. Application of photography in astronomical observations.

ATELIER (*Fr.*) *See* GLASS HOUSE.

ATMOSPHERE, AND AIR. In pictorial art, terms describing the effect produced by the medium in nature through which every object is viewed, and therefore to be transferred to the imitation on the picture. The effects which it produces are an indispensable part of the knowledge of every artist.

ATMOSPHERE, EFFECT OF, ON LIGHT. Like all other diaphanous substances, the atmosphere deflects oblique rays of light from their rectilinear course. This phenomenon is called refraction. The atmosphere also, notwithstanding its transparency, intercepts and reflects the rays of light, or objects would not be illuminated unless exposed to the direct rays of the sun. The illuminating power of the atmosphere is so feeble that to an eye placed in the shade the stars are visible in broad day. The

colour of the gas or air which composes our atmosphere is blue, but the tint is so slight that it cannot be appreciated by the eye unless clouds are absent, and a mass of it several miles thick be viewed at once.

ATMOSPHERE, ACTINIC STATE OF THE. *See* ACTINIC STATE.

ATTITUDE (*Gr.*) In the fine arts the position and gesture of a figure or statue; or such a disposition of their parts as shall best display some grace or beauty, or serve to express the action or sentiments of the person represented—generally termed in photography, pose.

ATTRACTION (*Lat.*) A term used to denote the tendency we observe in bodies to approach each other, and resist separation.

ATTRACTION, CHEMICAL. *See* AFFINITY.

AURINE, for staining the sensitized film, has been suggested as a substitute for the "backing" of dry plates, to prevent blurring; but it is objected that the aurine diminishes sensitiveness. One drachm of aurine to one ounce of alcohol; and of this thirty drops are added to each ounce of collodion. With alkaline development, if not previously washed out, the colour is apt to change to a deep red. This is, however, to be got rid of by washing with liquor ammoniæ or spirits of wine after fixing. *See* STAINING THE FILM.

AURO-CHLORIDE OF SODIUM. *See* SODIUM AURO-CHLORIDE.

AURUM (*Lat.*) Gold. Chemical symbol, Au.

AUTOTYPE PROCESS. Sensitize the tissue by floating on a solution of bichromate of potassium 1 ounce, water 25 ounces, until the tissue becomes limp (occupying about two or three minutes); then place it face uppermost upon a piece of blotting-paper, until half dry, when the sheet is hung up and the drying completed. Expose under the negative in the ordinary way, the time of exposure being judged by means of the Autotype actinograph. Clean the plate with benzine, and warm; then with a flannel rub a thin film of bees-wax over the warm plate. Collodionize in the usual manner. Plunge the collodionized plate into cold water, where it should remain until the alcohol and ether are eliminated. Soak the exposed tissue in water until limp, and having rinsed the film in clean water, lay the tissue on the plate. Take a piece of single transfer paper and place it, glazed side uppermost, on the tissue resting on the collodionized plate, and secure perfect contact by means of the "squeegee" (*q.v.*) To do this properly, begin just past the middle, and with a smart stroke drive the water off at one end; then begin again in the middle and drive the water off at the other side. To develop, place the plate in hot water, 100° to 130° Fahr., and soak until the paper floats off; remove it, and dash water over the plate. Finish the development in this way, or place it in a water box to develop itself. Gradually those parts of the gelatine which have not been acted upon by light dissolve away, leaving the picture in perfect gradation of light and shadow. If the picture be too dark, hotter water should be used; if too light, develop more gradually with cooler water. Place the developed plate in the alum bath (one ounce to fifty of water), for three minutes, wash, dry, and spot out with oil colour with turpentine. Ivory black, light red, and French blue are the most useful colours, and will give the whole range of photographic tints. To transfer, soften double transfer-paper in warm water about 100° Fah. until it becomes slimy, and then plunge it into clean cold water. Plunge the plate bearing the developed picture into clean cold water, lift it out with some water upon the surface; upon this lay the softened transfer-paper, and apply the squeegee. Allow it to dry, when it will strip from the glass. If the prints so obtained be mounted, and rolled in the ordinary way, the excessive gloss will disappear, and the result will look like a very highly-albumenized paper print. If it be desired to get rid of the gloss before mounting, lay the prints between damp blotting-paper,

and they will, when dry, resemble very fine silver prints on highly-glazed albumenized paper. If it be desired to preserve the gloss, when mounted, put on four thicknesses of softened transfer-paper instead of only one. This will dry and form a card, which will leave the glass with the picture retaining all the brilliant surface. After the removal of the prints the plates will not require cleaning, but only re-waxing, after scraping off any loose collodion that may adhere to the edges. As the tissue loses its sensibility the moment it is wetted, the development may be carried on with only the protection of a white blind over the window.

AWNINGS. Used for protecting the glazed roof of the glass house from the direct rays of the sun, which cannot otherwise be excluded. They are of various forms, as the peculiarities of the roof may demand, or the ingenuity of the artist suggest. Sometimes a canvas sheet may be run on supports fixed to the roof, or movable slats, after the pattern of a venetian blind. A coat of thick starch paste spread over the glass of the roof may sometimes efficiently exclude troublesome rays.

AZOTE (*Gr.*) Nitrogen.

B. The chemical symbol of Boron.

Ba. The chemical symbol of Barium.

BACKGROUNDS. A most important, but too much neglected, feature of the photographic picture. An ill-chosen or misused background will mar the most refined and exquisite effect of portraiture. The perfectly plain and even background gives the figure an appearance of being inlaid. Clumsily-designed and badly-painted representations of interiors and exteriors, such as serve to satisfy photographers, are quite sufficient to render any picture ridiculous. The background for a portrait should be delicately graded from dark to light, to relieve some parts of the figures and subdue others—the practice having largely obtained of the masters of portraiture, to place the dark side of the figure in contrast with the lights of the background, and *vice versa*. To Adam-Salomon belongs the credit of bringing before the notice of photographers the extreme importance of the background in their pictures, and illustrating the practice of the painters. The late Mr. Rejlander adopted the plan of making *original* graduated backgrounds by partially exposing on a dark background, and for the remainder of the time having a white screen of three or four feet square kept moving in front of the portion of the background which required lighting up, the constant movement of the screen preventing any sharp lines. Before the exposure of the plate, Mr. Rejlander would consider the pose and the defects of the background, and give directions to his assistant for the proper movement of the screen. By such means he was enabled to attain great variety of effect, and by his undoubted artistic ability and ingenuity to devise means to secure characteristic effects. For the head and bust portrait some of the most artistic and effective backgrounds are to be obtained by the use of the alcove and conical backgrounds.

BACKGROUND, THE ALCOVE. A semi-circular background with canopy and wings permitting ready arrangement, so as to control the light on the sitter, and on the background. The construction of the alcove background may be thus briefly described. A semi-circular background, of which the diameter is five feet, and the height seven or eight feet, covered in at the top, and having hinged wings at the sides and at the top. The whole is set on castors, so that it may readily be moved into any required position. By such a background every variety of lighting may be arranged with the greatest ease and expedition.

BACKGROUND, THE CONICAL. A circular piece of zinc, or cardboard, or other material, of five or six feet in diameter, is slit to the centre; by overlapping the edges of the cut, the centre of the circle is thrown back, and the outside of the circle is contracted

in size, but retains its circular shape, assuming the conical form. Fixed in this form it is mounted on a head-rest base, in which it may be moved up and down as required. The effect when placed behind a sitter is to produce shadows on the conical background, where the light strikes the sitter, and *vice versa*. The explanation of this may be understood in a moment: the edge of the background nearest the light, casting a delicate shadow of more perfect gradation than the most cunning brush can produce, and the opposite side of the background—that farthest from the light and behind the shaded side of the sitter—is illuminated by the rays of light falling on its surface.

BACKGROUNDS, SCENIC, should be used with great care and discrimination. Suggestive, rather than hard and sharply defined, their intention should be confined to favouring breadth of effect, and to concentrate the interest on the figure.

"BACKING" FOR PLATES. With some kinds of emulsion, where the films are very transparent, the image is subject to blurring. This may be, in a measure, remedied by brushing over the back of the plate, with a hog's bristle brush, a "backing" composed of powdered burnt sienna, 1 ounce; gum, 1 ounce; glycerine, 2 drachms; water, 10 ounces.

BALANCE (*Fr.*) A most requisite quality in an artistic composition; the proper regard of lines in their relation to each other, for securing stability and strength; and of lights and darks in proportionate masses, whereby harmony is attained. The balance of lines and light and shadow are of first-rate importance in the photographic picture, or, indeed, any work of art. All lines must be balanced or compensated, or a weak and tumble-down effect is given to the picture; these lines of balance can be secured in the pose of the head, the lines of the shoulders, the arms, and the drapery; and, if necessary, by the introduction of an "accessory," *q.v.* It is a good plan, in posing the figure, to secure first a good *outline* to the subject, then to arrange the inside lines. Let your lines be simple, and your lights and shadows broad and honest. Avoid patchiness, and broken niggly lines.

BALANCE. (*Fr. and Lat.*) A machine for weighing bodies. For general purposes one in which a two-grain weight will throw the beam is sufficiently fine.

BARIUM. Ba-136·8. A white and lustrous metal, which gradually oxidises in the air.

BARIUM CHLORIDE. $Ba\,Cl_2$. Commonly employed as a test for sulphuric acid, with which it forms an insoluble precipitate of sulphate of baryta.

BARIUM NITRATE. $Ba\,(NO_2)$. Forms octahedral crystals, which are anhydrous. It is considerably less soluble than the chloride of barium, requiring for solution 12 parts of cold, and 4 of boiling water. Sometimes used in the negative bath as a preventive of "pinholes," *q.v.*

BASE. (*Gr.*) In chemistry a term generally applied to metallic oxides, or the leading constituent of compounds. Thus, soda is called the base of sulphate of soda; and Sodium is the metallic base of Soda; hence the distinction into salifiable and metallic bases.

BATH. A vessel for holding the sensitizing and other solutions. May be of glass, porcelain, ebonite, or gutta-percha; of these, glass will be found the most lasting and serviceable, allowing inspection of the state of the solution. The glaze of porcelain baths is liable to fracture, when the bath must be laid aside; ebonite is very brittle; and gutta-percha is too often impure. The glass bath should be fitted into a wooden case, not too tightly, the case having a water-tight top.

BATH, NEGATIVE SENSITIZING. *See* NEGATIVE BATH.

BATH, POSITIVE SENSITIZING. *See* PRINTING BATH.

BEAUTY. That assemblage of graces, or proportion of parts, which pleases the eye, and excites in us agree-

able sensations, or causes our admiration. In the fine arts, the harmony and justness of the composition in all its parts.

"BEAUFOY'S ACETIC ACID." *See* ACETIC ACID.

BEECHEY'S EMULSION PROCESS. *See* EMULSION PROCESS.

BEER DRY PLATES. *See* DRY PLATE PROCESSES.

BELLOWS CAMERA. A form of camera where the sides are of leather and expand in the same manner as an accordion. Designed to considerably lighten the intrument, it has been found advantageous in many respects. Care should be used that dust be not permitted to accumulate, or with every opening and shutting of the instrument particles are set flying which will settle on the plate.

BENDING GLASS TUBING. Place the part where the curve is required in the flame of a spirit lamp, and keep turning round between the fingers, so that the glass heats equally until the glass feels softened, when a gentle pressure by the hands will give the necessary bend.

BENZENE: BENZOLE. C_6H_6. A limpid liquid, obtained commercially by distilling off the most volatile constituent of "coal naphtha." It does not mix with water, but is dissolved in any quantity of alcohol or ether. A rapid drying varnish may be made with benzole, but it should first be purified by redistillation, since ordinary benzole sometimes leaves a greasy residue on drying.

BERLIN WARE. A manufacture of pottery of such a quality as to resist the action of photographic chemicals. In it, nitrate of silver may be fused with safety.

Bi. The chemical symbol of Bismuth.

BICHLORIDE OF MERCURY. *See* MERCURY BICHLORIDE.

BICHROMATE OF POTASH. *See* POTASSIUM DICHROMATE.

BICARBONATE OF SODA. *See* SODA CARBONATE.

BI-CONVEX. Double convex.

BIFURCATION (*Lat.*) Shooting out by division into two heads or forks.

BINOCULAR CAMERA. A name given to a stereoscopic camera fitted with a pair of lenses, equal and similar in every respect, and with their axis parallel.

BINOCULAR VISION. When the two eyes are directed upon a single object, we gain the power of judging of its distance as compared with that of any other point, and this we seem to gain by the sense of greater or less effort required in causing the optical axis to converge upon the one point or the other. Now, a solid object may be regarded as composed of points which are at different distances from the eye; hence, in looking at such an object, the axis of the two eyes are rapidly and insensibly varying their angle of convergence, and we as rapidly are gaining experience of the difference in distance of the various points of which the object is composed, or, in other words, an assurance of its solidity. *See* MONOCULAR VISION.

BINOGRAPHS, BINOCULAR PERSPECTIVE PORTRAITS. It was supposed that a single portrait could be obtained which would exhibit the appearance of solidity we observe on viewing the duplicate pictures of a stereoscope. This, it was thought, could be done by using a camera made to revolve in a horizontal plane through an angle, its axis being always directed to the same part of the sitter.

BISULPHIDE OF CARBON. *See* CARBON BISULPHIDE.

BITUMEN OF JUDÆA. *See* ASPHALT.

BLACK VARNISH. *See* VARNISH.

BLACKING FOR CAMERAS, &c. The inside of the body of the camera box should be blackened with a coating of dead colour, or covered with black velvet. Lens tubes are sometimes blackened by a solution of bichloride of platinum in water. Bone black or ivory black, ground to a proper consistence in water and a little glue, applied as water colour, may serve well.

BLANCHARD BRUSH. Round one end of a strip of glass, six inches long by two wide, a double fold of

swan's down calico is fixed by means of thread, or by an india-rubber band. This brush will be found of great service in the dry plate processes for applying substratum to plates.

BLISTERS occurring in some of the dry-plate processes are generally attributed to the preservative, especially those of a gummy nature. The blisters are often very numerous, and are a source of great trouble, as when formed in development they generally fill with the developing solution, and on drying a stain is formed; or if in subsequent washing or fixation, a dark ring, indicating their extent. As a remedy, a substratum may be used; or if, after exposure, the plate be washed and dried, it should be coated with dilute alcohol; this treatment rendering unnecessary the use of a substratum.

BLUE FILMS are caused either by the bath being too strong for the collodion, or the collodion being insufficiently iodized. One of the chief causes of these blue films is the spare iodizing of the bath; also low temperature of the bath solution. *See* NEGATIVE BATH.

BLUE GLASS. The use of blue glass for the "light" of the gallery is strongly advocated by some photographers, but against this has to be urged the evil of a great diminution of illumination, and consequent increase in time of exposure of the sensitized plate. The only gain appears to be that the light is less trying to the eyes of the sitter. If the subdued light tends to an improvement in the "expression" of the sitter, the lengthened sitting must be considered *per contra*. However, blue glass, stained with cobalt, is said to be very permanent in colour, while white glass, containing manganese, is affected by light, becomes of a reddish tint, losing very much of its transparency.

BLUE TONE IN PRINTS. Probably due to over-toning, or to acid toning solution.

BLURRING. Produced by pencils of light passing through the film into the body of the glass, and then suffering internal reflection at the back of it, and thus acting again upon the back of the film in a different part of it. The defect is in some measure to be cured by applying a non-actinic varnish to the back of the plate. *See* BACKING FOR PLATES.

BODY. A term used in art; the antithesis to transparency, thinness, and weakness;—as "body" colour in contradistinction to transparent colour in painting; and pictures or photographs with no body, in opposition to those which have plenty of reduced material and of vigour. Also applied to substances with regard to the quantity of stuff and substance contained in them; hence we have papers with body, papers without body.

BOILING (*Fr.*) or EBULLITION. The bubbling up of any fluid. Boiling in general is occasioned by the discharge of an elastic fluid through that which is said to boil. The boiling of water, for instance, is occasioned by the lowermost particles being rarified into vapour by reason of the vicinity of the bottom of the containing vessel to fire. In consequence of this, being greatly inferior in specific gravity to the surrounding fluid, they ascend with great velocity, and, agitating the body of water in their ascent, give it the tumultuous motion called boiling. Every liquid has a fixed point at which boiling commences, and this is called.

BOILING POINT; thus water begins to boil at 212°. After a liquid has begun to boil, it will not become hotter, for although a stronger heat makes all liquids boil more rapidly, yet it does not increase their temperature.

BOILING BATHS. *See* NEGATIVE AND PRINTING BATH, TO RESTORE.

BOWL NEGATIVES. Negatives can be taken by means of a panoramic lens, upon the segment of a sphere, including a hundred degrees of angle of view in all directions. Prints can be obtained from such negatives, either by a process of copying upon another bowl by means of a panoramic copying lens placed at the common centre of both, or by laying a sensitive piece of silk

upon the convex side of a suitable cushion and bringing the negative into contact; but distortion ensues on its being flattened out.

Br. The chemical symbol of Bromine.

BRILLIANCY (*Fr.*) A quality of the negative, only secured by perfect illumination, and clean and skilful manipulation. In the first place, the light directed on the object must be arranged to secure the desired effect, for no jugglery of the plate can remedy the failures of illumination; and in the second place, though good manipulation cannot make brilliancy out of flatness and harshness, yet faulty manipulation may spoil the most artistic effect.

BRITISH GUM. Dextrine, *q.v.*

BROKEN NEGATIVES. Where the negative is broken across the length or breadth of the glass, so that strips round the edges clasp all the pieces, lay the negative on a sheet of glass, varnish upwards, and match the pieces with the greatest exactness. Cut four strips of tough cartridge paper, the length of the sides and one inch in width, and to one side apply melted glue, and stick to the edge of the broken negative, one half over-lapping the edge. Do this to the four sides, then carefully turn the negative and press down the over-lapping edges on the other side of the glass. By this treatment the negative requires no protecting glass, and may be printed in the frame as an ordinary negative. Where the negative is broken all over, carefully put the pieces together as before, but varnish side downwards. Take a piece of plain unsalted paper to cover the surface of the negative, allowing half an inch margin all round, glue one side, and stick down on the glass side of the negative, and press out all air-bubbles. Turn the negative over, and after seeing that the adjustment is perfect, stick down the projecting edges over the varnished side. As the paper dries it will contract, and the more tightly draw together the broken pieces of glass. Apply benzine to the paper to render it transparent.

BROMIDES. A class of metallic salts which are of great importance in photography. The most useful bromides will be found described under heading of their distinctive metals.

BROMIDES IN ALBUMENIZED PAPER. The use of bromides for increasing sensitiveness and securing greater delicacy has been advocated. One grain of bromide and six grains of chloride of ammonia has been used with great advantage.

BROMIDE OF AMMONIUM, ETC. *See* AMMONIUM, ETC., BROMIDE.

BROMIDE OF URANIUM DRY PLATES. *See* EMULSION PROCESSES.

BROMIDES, INFLUENCE OF, ON COLLODION. Generally, to decrease contrast in the image, and assist the bringing out of detail.

BROMIDES USED IN COLLODION. Bromides in collodion produce detail, and tend to reduce the time required for the impression of light. Loss of intensity of the image is suffered. In photography have been used the bromides of ammonium (8·16), cadmium (5·88), potassium (6·64), zinc (7·10); the figures representing the combining proportions of bromine. Of these bromides the first two named are now most generally employed in the manufacture of collodion, *q.v.*

BROMIDE, TO ADD EXTRA, TO COLLODION. Where a collodion is insufficiently bromised, dissolve eighteen grains of the bromide in one ounce of plain collodion, and the addition of every half drachm of this to the ounce of collodion will give very nearly an extra grain.

BROMINE. (*Gr.*) Br 79·75. Usually extracted from bittern, the uncrystallizable residuum of sea water; is, at ordinary temperatures, a brownish-red liquid, very volatile, the vapour being poisonous. Slightly soluble in water, more so in alcohol, and yet more in ether. It forms a large class of salts, of which the bromides of ammonium, cadmium, silver, and potassium, *q.v.*, are the most familiar to photographers.

BROMIZED COLLODION. A collodion from which iodides are absent, as

that sometimes used in the "tannin process" of Major Russell's formula, composed of 16 drachms of bromide of cadmium, 10 grains of pyroxyline to 1 ounce each of alcohol and ether.

BROMO-IODIZED COLLODION. A collodion in which bromides and iodides are used.

BRONZING. Bronzing in the shadows of a print generally occurs when the paper is rich in silver and organic matter, and especially when the exposure under the negative has been prolonged. The paper should be rendered less sensitive.

BUCKLE BRUSH. A brush owing much of its usefulness to the fact that it may be constantly renewed, and therefore kept clean. It is a hook formed at the end of a silver wire, and drawn tightly into a glass tube which serves as a handle; fine cotton wool pulled out by the fingers being drawn through the hook, and replenished as often as occasion requires.

BUFF, and BUFFING. The buff was used in the Daguerreotype process for polishing the silver plate, the process being termed buffing. The hand-buff was a piece of wood about sixteen inches long and five inches wide, having a handle at one end, and covered with velveteen, the fine ribs being across the buff. The buffing-lathe was a wheel covered with wash-leather or doeskin, and turned by the foot. The hand-buff is sometimes used for cleaning the glass plate, but the process of polishing the plate has given place, in great measure, to albumenizing, *q.v.*

BUOYANT (*Fr.*, *Span.*, *Dutch*). Floating: incapable of sinking; sustaining flotation; light.

BURNISHING. (*Fr.*) Of the many roller presses, those lately introduced as "burnishers" are undoubtedly the best. By them any amount of gloss may be obtained, but, in many cases, too high a polish is used. The fault is vulgar. Burnishing undoubtedly improves the tone, and gives richness, transparency, and beauty to the print. Ordinary care will keep the burnisher in good order for years.

BURNT-IN PHOTOGRAPHS. *See* ENAMELS.

C. The chemical symbol of carbon.

Ca. The chemical symbol of calcium.

CABINET PICTURE. The style of a popular picture, specially adapted at the time of its introduction for full-length portraits of ladies. Fashion has worked its changes in dress, and now the cabinet card has a blank space erst filled up by voluminous expanse of costume. To suit this change, the "Promenade" picture (*q.v.*) was introduced. The size of the cabinet card is $6\frac{1}{2}$ by $4\frac{1}{2}$ inches.

CADMIUM. Cd 111·6. A scarce metal, bearing in appearance a resemblance to tin. Air and moisture have little effect upon it, and this stability renders its salts extremely valuable in photography, as in a crystalline state they have little tendency to deliquesce and oxidise.

CADMIUM BROMIDE. Cd Br. Occurs in acicular crystals or nacreous scales. The crystals contain water, but when sublimed, the bromide condenses in anhydrous pearly scales. Preferred by many photographers above the other bromides for its stability, purity, and solubility.

CADMIUM CHLORIDE. $Cd\,Cl_2$. A soluble, well crystallizing salt.

CADMIUM IODIDE. $Cd\,I_2$. Obtained by heating filings of cadmium with iodine, or mixing them in a moist state. Is very soluble both in alcohol and water, crystallizing in large six-sided tables of a pearly lustre, which are fusible and decomposed at a high temperature. When pure, its alcoholic solution is permanent, and collodion iodized with it does not become discoloured, or undergo any visible alteration by time, if kept in a cool, dark place. On the other hand, iodide of cadmium impairs the fluidity of the collodion; and the effect of the nitrate of cadmium formed in the sensitizing bath is to render it gradually acid.

CALCAREOUS. (*Lat.*) Partaking of the nature and properties of lime.

CALCINE. (*Lat.*) Reduce to ashes—burn up.

CALCIUM. Ca 39·9. An extremely oxidizable metal, of which lime is the oxide. Its compounds with the halogens are generally deliquescent, and prone to oxidize.

CALCIUM BROMIDE. Ca Br. White, and deliquescent, its watery solution yielding silky hydrated crystals.

CALCIUM CHLORIDE. $Ca\ Cl_2$. Is extremely soluble in water, its attraction for it being so great that it soon deliquesces from absorption of the moisture of the atmosphere. Also extremely soluble in alcohol.

CALCIUM IODIDE. Ca I. Dissolved in water, and evaporated, it furnishes white deliquescent crystals. It is extremely soluble in water, and alcohol even when absolute. The alcoholic solution is discoloured by light, and collodion iodized with it becomes gradually reddened as with the potassium salt. It is not much used, being generally inferior to some other of the iodides.

CALEFY. (*Lat.*) Grow hot; be heated.

CALOMEL. *See* MERCURY SUBCHLORIDE.

CALORIFIC. (*Lat.*) Heating: having the quality of producing heat.

CALORIFIC RAYS OF THE SPECTRUM. The heat rays. Various experimenters have fixed the maximum intensity of the heating effects in different parts of the spectrum, principally at and beyond the red rays, but this was found to arise mainly from the nature of the prism used. The calorific rays which proceed from terrestrial bodies are almost entirely stopped by glass, so that the photographic lens, by intercepting them, prevents their action on the sensitized plate; but as the calorific rays proceeding direct from the sun are not intercepted by glass, this does not apply in the case of obtaining a photograph of the sun's image.

CALOTYPE (*Gr.*), or, as sometimes known, the Talbotype, is a negative process on paper. The process is a very interesting one, and consists of five operations. *The first*: Iodising the paper. Float the face of the paper upon a twenty-grain nitrate of silver bath for a minute or two (as the particular paper may be found to require). Remove the paper from the bath, dry, and immerse in a solution containing twenty grains of iodide of potassium. Then wash in several changes of water. Dry spontaneously. Or, this double operation may be effected at once by brushing over the surface of the paper, by the Buckle brush, a solution of iodide of silver and potassium. *The second*: To excite the paper for exposure. If the above operations have been properly performed, the paper is unaffected by light. To sensitise, prepare (A) nitrate of silver 50 grains, glacial acetic acid $1\frac{1}{2}$ drachms, to 1 ounce of distilled water—filter; and (B) aceto-nitrate of silver 3 drops, saturated solution of gallic acid 3 drops, to 1 drachm of distilled water—filter. Mix in 1 ounce of distilled water 15 drops of solutions A and B. Apply copiously with a Buckle brush. Drain for a minute, blot off the surplus solution with clean blotting-paper. The paper is now ready for exposure. *The third*: Exposure, under good conditions, about six minutes. *The fourth*: Development. Mix together 10 parts of solution A, and 50 of solution B, and as before, by means of the Buckle brush, spread this solution over the surface of the picture. Repeat this, not allowing the paper to become dry until all the detail is out. *The fifth*: Fixing. Wash the picture in two or three changes of water, then place in a solution of hyposulphite of soda until the yellow colour of the iodide has disappeared. Wash well in several changes of water. These negatives are rendered semi-transparent by "waxing" (*q. v.*), or by immersion in almond oil.

CALX. (*Lat.*) Anything reduced to powder by burning; *i. e.*, such mineral constituents, found in most substances, as resist the action of fire when everything else is burnt.

CAMEO PORTRAITS (*Fr. and Ital.*) Small portraits printed on albumenized paper, and mounted on card, which in a press is then made slightly convex.

CAMERA (*Lat.*) The dark box in which the image of an external object formed by the photographic lens can be received on the sensitized plate. It should be perfectly light-tight. To test this, cap and cover the lens, remove the ground glass, and, with the focussing-cloth shutting out all light behind the head, examine thoroughly the interior of the box. Thoroughly steady—drawing out and shutting easily Made of well-seasoned wood. The ground glass and plate should occupy exactly the same position in the camera. (*See* ACTINIC FOCUS OF LENS.) It should afford facility for ready change of lens. The plan of mounting each lens on a separate front board to fit into grooves on the front of the box having many advantages. It should admit of easy and full contraction and expansion, contraction beyond the back focus of the smallest lens used with it, and expansion to the extreme focal length of the largest objective adapted to it. The interior blackened. (*See* BLACKING FOR CAMERAS, &c.)

CAMERAS, CARE OF. Photographic apparatus treated uncarefully not only is soon destroyed, but is ever the victim of some trifling (yet very worrying) ailment. The camera roughly treated soon becomes shaky and cracked, unreliable of focus, and for the exclusion of extraneous light. The lenses will not fit properly. The ground glass is broken, or will not slide into place. The silver from the sensitized plate is allowed to run into the box to work its work of destruction. Dust is permitted to accumulate inside the camera, to settle on the sensitized plate at its own sweet will. All these and many other results of carelessness are easily avoided.

CAMERA LUCIDA. An optical instrument for the purpose of making the image of any object appear on the wall in the light room, either by day or night.

CAMERA OBSCURA, or *Dark Chamber*. An optical apparatus, in which the light being collected, and thrown through a single aperture, external objects are exhibited distinctly, and in their native colours, on any white surface placed behind the machine.

CAMERA STAND. The support on which, in the field or studio, the camera rests. These stands are of great variety of form, the chief requisite being steadiness. In the field, a light portable folding tripod stand is most convenient, but in the studio, a table stand, with horizontal and vertical movement, and rack adjustment for raising and depressing the camera, will be found most suitable. Castors should be fixed on the front legs, that the stand may be readily moved about the studio.

CAMPHOR. $C_{20}H_{16}O_2$. A concrete essential oil obtained by distillation from the *Laurus Camphora* of Japan and China; occurs when pure in sublimed masses, which are tough, and cannot be reduced to powder without the aid of a few drops of spirit. Evaporates slowly in the air at ordinary temperature, soluble in alcohol, and very sparingly in water. Used sometimes as a detector of grease, and occasionally to prevent the decomposition of albumen, gelatine, tannin, and other organic solutions.

CANADA BALSAM. A kind of turpentine obtained from the *Abies Balsamea* growing in Canada and Maine (U.S.). Used for cementing the lenses which form an achromatic combination, and for mounting microscopic objects.

CANVAS PRINTING. *See* PRINTING ON CANVAS.

CAOUTCHOUC, or india-rubber, is sometimes made up into vessels for photographic use, but is unreliable, especially in contact with nitrate of silver, from the impurities imparted to it in manufacture. Also used in some varnishes and for mounting purposes. Caoutchouc is soluble in chloroform, ether, benzole, naphtha, &c.

CAPILLARY. (*Lat.*) Resembling

hairs; small; minute. In Physics, action in bodies of columnar solids with small interspaces.

CAP OF THE LENS. The cover of brass or pasteboard used for opening or shutting up the lens at the time of exposure of the plate, and for protection of the lens.

CAPSULES. Small shallow basins of Berlin porcelain, platinum, &c., for the reception of solutions for evaporations, &c.

CARBON. C 11·97. Occurs free in nature in two perfectly distinct forms—as *diamond*, a colourless, transparent solid, the hardest substance known, found crystallized in forms derived from the cube, sp. gr. 3·5;—and as (*graphite*) plumbago, or black lead, a black, opaque solid, with a metallic lustre crystallized in hexagonal plates. In combination carbon is very widely diffused.

CARBON BISULPHIDE. CS_2. A volatile, transparent, and inflammable liquid of great refractive and dispersive power. A solvent of sulphur, it is sometimes used to determine whether the yellow colour of a photograph is due to sulphur.

CARBON PRINTING. *See* PRINTING IN CARBON.

CARBON PROCESS; based on the principle that gelatine mixed with a solution of potassium dried in non-actinic light is soluble in water; but exposed to the action of light, the film is rendered insoluble. *See* AUTOTYPE PROCESS.

CARBON TISSUE. Paper evenly coated with coloured gelatine. The gelatine must not be too easily soluble, nor insoluble. As the gelatine alone would be too fragile, sugar and soap, or glycerine, are sometimes added to keep the film ductile and permeable. The basis of the colouring matter is carbon, India ink, bone black, or other finely divided carbonised matter. India ink is best, as it contains the carbon in a very finely-divided state, and is a rich black which may be tinted as desired by the addition of brown, blue, or red colouring matter. The gelatine mixture is prepared as follows:—Gelatine, 130 grains; soap, 15 grains; sugar, 21 grains; dry colouring matter, from 4 to 5 grains; water, 1 ounce. The gelatine, soap, and sugar are put in the water and allowed to stand for an hour; each colour is separately ground dry on a slab, and then, together with a little water. The gelatine is dissolved by placing the vessel containing it in hot water. Add the moistened colours to a little of the dissolved gelatine, ground on the slab, and add in small portions to the gelatine, keeping it stirred all the time. The paper, of a smooth, fine surface, can be coated with the gelatine by drawing it over the surface of the gelatine; or by coating a glass plate with gelatine evenly, and, before it dries, laying the paper, slightly moistened, over the film, and lifted off after a short time; or by pouring the gelatine over the surface of the paper. The bottle containing the gelatine is placed in hot water, as the mixture must be warm at the time of coating the paper. The bath should be kept at a temperature of 90° Fahr. by means of hot water. The quicker the paper is drawn over the gelatine, the thicker the coating will be. The room in which the tissue is dried must be well-ventilated and free of dust.

CARBON TRANSFER PAPER (Double), used in the transfer process, is a white paper coated with gelatine made almost insoluble by the addition of a solution of chrome alum. Forty-eight grains of gelatine are dissolved in one ounce of water, and to this about eight grains of glycerine are added. Before use, forty-eight grains of a saturated aqueous solution of chrome alum are dropped into the mixture while it is continuously stirred. The alum solution must not be added in one stream, or the gelatine will be rendered insoluble. By rinsing the gelatine with insoluble white or coloured substances a finer surface is obtained on the paper. In this case the glycerine, with twenty grains of sulphate of baryta and small quantities

of indigo blue, ultramarine, carmine lake, or other colours, finely powdered, may be rinsed with a little of the warm gelatine before the colour mixture is added to the gelatine. It must be added a very little at a time, and the gelatine solution kept well stirred the while. The chrome alum is added last, just before the gelatine solution is required for use. Filter through some fine muslin.

CARBON TRANSFER PAPER (Single) is prepared either by soaking the double transfer paper, just described, in a five per cent. alum solution; or in an aqueous solution of shellac obtained by boiling three parts of shellac and one part of borax in thirty parts of water.

CARBON TRANSFER PAPER, ENAMELLED, is lithographic chalk paper treated in the same way.

CARBONACEOUS. Containing carbon.

CARBONATE OF AMMONIA, ETC. *See* AMMONIA, ETC., CARBONATE.

CARBONATES. Salts which contain carbonic acid. Those used in photography, when soluble, are alkaline in their properties. Water containing carbonate of lime used for the nitrate of silver baths sometimes causes trouble in rendering it alkaline, and produces unexpected results in the toning bath.

CARBONIZED PLATES. Copper plates have been evenly covered with hydrocarbon in the form of finely divided powder, and by exposure to heat have been superficially converted into carburet of copper. These plates, covered with nitrate of silver, and exposed to light under a negative, will receive an image in pure milk-white silver. The tendency of the metallic plates themselves to reduce the nitrate renders the process of little value.

CARBOYS. (*Romaic*)). Large globular glass vessel surrounded by wicker work for its protection, used for containing acids, &c.

CARD PICTURE. A small picture measuring $4\frac{1}{2} \times 2\frac{1}{2}$ inches, mounted on a card. Now generally known as the "*Carte-de-Visite*."

CARE OF APPARATUS. *See* APPARATUS, CARE OF.

CARRAGEEN, or IRISH MOSS. A kind of sea-weed containing a jelly which has been used for re-sizing photographic paper, and in the waxed paper process.

CARTE-DE-VISITE (*Fr.*) The style of a small photographic portrait. *See* CARD PICTURE.

CARTON DURCI. Bristol board is rendered water-tight by being coated with linseed oil varnish and asphaltum, and made into dishes for the reception of photographic chemicals.

CASEIN, OR CASEINE. The albuminous principle of milk. In some of its properties it nearly resembles albumen; and is used in some of the printing processes on plain salted paper.

CASTOR OIL. Extracted from the seeds of *Ricinus Communis* or *Palma Christi*, cultivated in warm climates. Sometimes used in collodion.

CATALYSIS. (*Gr.*) Action of one body on another by contact, rather than that accompanied by change on both sides.

CATALYSOTYPE. A process invented by Dr. Woods, in which the paper was prepared with syrup of iodide of iron. As the development, after exposure, was effected by merely keeping the paper moist, it was thought that light set up a catalytic action on the silver salt, which then operated on the iron salt to produce the picture; hence the name.

CATECHU, OR TERRA JAPONICA. A gum of very astringent quality, obtained by decoction and evaporation from a species of *Mimosa* in India. It consists chiefly of tannin, and is sometimes used as a dry plate preservative—twenty grains to the ounce.

CAUSTIC (*Gr.*) A term applied to certain alkaline oxides and acid salts which destroy animal tissues, and pro-

duce effects like burning. The most familiar, nitrate of silver and potash. The fixed alkalies are all caustic.

CAUSTIC SURFACE — Caustic Curve. When a pencil of rays, after refraction through a lens, or reflection from a mirror, is affected by spherical aberration, the focus of the ultimate intersections of the rays which cross each other constitutes what is termed the "caustic surface," and a plane section of that focus passing through the axis of the pencil is called the "caustic curve."

CELLULAR. (*Lat.*) Consisting of little cells or cavities.

CELLULOSE, LIGNIN. Cellulose is the material which forms the cell-walls of the tissues of plants, and lignin is the deposit formed in the interior of the cell. The purest natural form is cotton, and in this form it is used in photography for the manufacture of pyroxyline, *q.v.* *See* Cotton.

CEMENT (*Fr. and Lat.*) Matter with which bodies are made to cohere.

CENTIGRADE (*Lat.*) Divided into a hundred degrees, as the

Centigrade Thermometer, where the space between boiling and freezing water is so divided. To convert centigrade into Fahrenheit, multiply by 9, divide by 5, and add 32; and from Fah. to the Centigrade scale, substract 32, multiply the remainder by 5, and divide by 9.

Centigramme. The hundredth part of a gramme, equal to ·1543 gr. Troy. *See* Metric System.

Centilitre. The hundredth part of a litre. *See* Metric System.

Centimetre. The hundredth part of a metre—nearly ⅜ of an English inch. *See* Metric System.

CERAMIC PHOTOGRAPHS. *See* Enamels.

CHAIR. *See* Accessory.

CHALK. A soft variety of carbonate of lime, sometimes used for cleaning glass plates, and for neutralizing acid solutions.

CHAMOIS LEATHER. Used in cleaning glass; but for this it requires preparation by soaking in soda for a considerable time, to neutralize the oil used in preparing the skin, and thorough after-washing in changes of clean water.

CHANGING BOX. An ingenious contrivance for transferring dry plates from the box to the holder in the open air.

CHARACTER (*Lat.*) A term used in the literature of art photography to express the individuality of a sitter.

CHARCOAL. *See* Animal Charcoal

CHARDON'S PROCESS. *See* Emulsion Processes

CHEMICAL AFFINITY. *See* Affinity, Chemical.

CHEMICAL EQUIVALENTS. *See* Vocabulary.

CHEMICAL FOCUS. *See* Focus.

CHIAROSCURO (*Ital.*) Distribution of the lighter and darker shades over a painting, engraving, or photograph. Sometimes spelled *clare-obscure* or *clair-obscure*. Known by those objecting to the Italian form, who would supersede it by some English combination, as *light and shade;* but the thing being common to works of art of all countries, the objection to the term *chiaroscuro* is rather fanciful.

CHILDREN, PHOTOGRAPHING. *See* Posing.

CHINA CLAY. *See* Kaolin.

CHINA INK. Finely divided carbon made into sticks with gelatine.

CHLORATES. Compounds of chloric acid with a base.

CHLORIDE OF AMMONIUM, Etc. *See* Ammonium, Etc., Chloride.

Chloride of Lime Toning Bath. *See* Toning Bath.

Chlorides. A term generally used to designate the compounds of chlorine which are not acids. The chlorides used in photography will be found under their respective metals or bases.

CHLORINE (*Gr.*) Cl 35·37. A greenish yellow gas of pungent odour: sp. gr. 2·45. It occurs in very large quantities in common salt. The gas itself has not been found of much practical use in photography, but some of

its combinations are extensively employed.

CHLORO-BROMIDE. *See* EMULSION PROCESSES.

CHLOROFORM (*Gr.*) C_2HCl_3. A solvent of gutta-percha and several resins used for varnishing purposes. It has also been used in collodion.

CHRIPOTYPE (*Gr.*). An ingenious process, invented by Sir John Herschel, in which paper coated with a moderately strong solution of ammonia-citrate of iron, dried in the dark, and exposed in the camera or under a pressure frame until a faint image appears, is developed by a neutral solution of chloride of gold to a purple tint. Wash the picture in several changes of water, fix in a weak solution of iodide of potassium, then again wash thoroughly, and dry.

CHROMATE. Salt in which the acid is the chromic, generally that in which the oxide of iron is the base.

CHROMATIC (*Gr.*) In the Fine Arts, colouring.

CHROMATIC ABERRATION. *See* ABERRATION, CHROMATIC,

CHROMATYPE. A name given to that class of photogenic decompositions in which chromic acid is partially deoxidized. The following is one method of several adopted for getting photographs by chromium salts. The paper is soaked in a saturated solution of bichromate of potash, and dried in front of a brisk fire. The paper is of a bright yellow colour, but by exposure to the sun under a negative, a positive of a deep orange colour is produced. Washing in water removes the yellow salts from the lights; but the reduced sesquioxide in the shadows remain. The paper should be well sized, or the bichromate will be only feebly decomposed.

CHROMIC ACID. A teroxide of chromium, sometimes used to distinguish between prints toned by sulphur and those by gold, the presence of metallic gold protecting the shadows in some measure.

CHROMOTYPE, HELIOCHROMY. The styles used by experimenters in the art of photographing in natural colours to describe their work.

CHRONDINE. A form of gelatine prepared from cartilages.

CIRCLE OF LEAST CONFUSION. The nearest approach to a focus of a pencil after oblique reflection or refraction.

CITRATE OF SILVER, ETC. *See* SILVER, ETC., CITRATE.

CITRIC ACID. $C_6H_8O_7$. A tribasic acid found abundantly in the juice of the lemon, citron, and other fruits. It is in a developer a powerful retarder to the reduction of silver, and is therefore used in the pyrogallic solution used for intensifying negatives developed by iron. It is also sometimes added to the printing bath when the paper sensitized thereon prints to a slate colour.

CLARIFY (*Fr.*) Purify or clear any liquid; separate from impurities.

CLEANING DAGUERREOTYPES. *See* COPYING.

CLEANSING thoroughly all glass vessels, &c., is a point of absolute importance in all photographic manipulations. The rule should be to clean immediately the vessel is out of use, as it is then most readily purified, and is ready for immediate use. *Collodion Bottles.*—Let the ether and alcohol evaporate; the film remaining in the bottle may then be easily removed by means of cold water and a bottle brush. Rinse when clean with a little alcohol. *Developing Glasses.*—Thoroughly wash out all developing utensils every night. Black precipitate may be removed with nitric acid. *Sensitizing Baths*, on being emptied, should be thoroughly rinsed with cold water. No particles of collodion film or dust should be permitted to dry on the sides of the bath. A flat stick covered with rag should be used to remove all dirt settled in the corners. *Lenses* should be carefully kept in a glass case, if possible, and when brought into use, should be dusted. Silk must not be used, as it is liable to scratch. Wash leather or tissue paper will be found best.

CLEARNESS. The absence of any action except that induced by the impact of light under proper artistic conditions. It implies the exact amount of exposure, both as to the intensity of the light, and its duration of action on the sensitized plate; the exclusion of all extraneous light; perfect optical arrangement, so that the image is sharp and evenly illuminated; the lighting of the object such that the chiaroscuro is perfect; and clean and skilful chemical manipulation. The causes of failure are dirty plates; unclean hands, frames, or vessels; impure chemicals; solutions too strong or too weak, or those of unknown or inconstant strength; extreme heat or cold; bad water, &c.; lenses with foci not coincident, or with no sharp focus, or of too short focus; camera shaky or not light-light, or not properly adjusted to the focussing glass, or open in front to rays from any object other than the one photographed, or deficient in means of absorbing the light scattered by the lenses or the mounting, &c.; grease or vapour on the lens, &c.; feeble light, or too intense, or not properly directed on the subject; light coming too obliquely from parts of the object; under- or over-exposure; careless, dirty, unequal, or dilatory manipulation; forcing the development; and too long-continued intensification, and light striking the plate during development, &c., &c.

CLICHE (*Fr.*) A stereotype plate; adopted in photography as a term for the negative and moulds used in silver and photo-mechanical printing.

CLIPS (*A.S.*) Wooden clasps for suspending paper in drying after silvering. *See* DRYING ROOM.

COAT. (*Fr.*) To overspread. Generally used as a term for covering the glass plate with the films of collodion, varnish, &c.

COATING FLUID. *See* SUBSTRATUM.

COATING THE PLATE. *See* COLLODION, COATING THE PLATE WITH.

COBALT. A metal resembling, in its photographic applications, iron, nickel, and chromium. Its compounds with sulphur and arsenic have been found to be affected by light.

COFFEE DRY PLATES. *See* DRY PLATE PROCESSES.

COHESION (*Lat.*) The force by which the particles of bodies unite and remain in contact so as to form one mass.

COLD, EFFECT OF, ON SENSITIZED PLATE, ETC. The sensitizing bath, when very cold, produces blue, thin films, and generally the chemical action is inactive and unvigorous when the thermometer stands low. Remedy: warm the dark room. Developing solutions should be gently warmed, not heated.

COLLODIO-ALBUMEN DRY PLATES. *See* DRY PLATE PROCESSES.

COLLODIO-BROMIDE. *See* EMULSION PROCESSES.

COLLODION (*Gr.*) A glutinous, transparent fluid, prepared by dissolving pyroxyline or gun-cotton in a mixture of alcohol and ether. In photography, certain iodides and bromides are added to render the film susceptible to the formation of a fine layer of iodide and bromide of silver in the negative bath. Iodides alone produce a dense image lacking in detail, and slow to be impressed by light; bromides alone give an image faint, but full of detail, and the exposure required to impress the latent image is shorter than when iodides are employed. In the judicious mixture of these, a film is produced which combines, when sensitized, the delicacy and detail of the bromide and the density of the iodide, without great loss of sensitiveness. *See* BROMIDES USED IN COLLODION; and IODIDES USED IN COLLODION.

COLLODION, COATING THE PLATE WITH. The plate is held by the corner in the left hand, resting on the edge of the first finger, and held by the tip of thumb, above. A little practice in balancing the plate is necessary, so that it is held firmly, yet not too rigidly. Guard against the bad habit of spreading all the fingers under the plate, as the warmth of the hand causes too rapid

"setting" of the film on the portions of the plate made warm by the fingers. Hold the plate perfectly horizontal when pouring on the collodion, which should be done at the corner diagonally opposite that held, then tilted so that the collodion runs gently along the top edge, then to the corner held, and escaping the tip of the thumb to the bottom corner, under which the collodion bottle should be held to receive the surplus collodion. Gently rock the plate to prevent ridges, and when set so that the film receives the impression of the finger, as would soft wax, without tearing, place in the bath. Do not flurry.

COLLODION, COATING THE PLATE WITH, FAILURES IN. (1). *Transparent, insensitive margins*, showing when the plate is withdrawn from the bath, caused by the collodion film drying too much before the plate is placed in the bath. (2). *Rottenness of the film* is caused by the immersion of the plate before the collodion has "set." (3). *Inequality in the thickness of the film* shows that the coating is unskilfully done. (4). *Spots* emanating from the corner held in coating tell of dirty fingers. (5). *Insensitive spots in the middle of the plate*, of round form and corresponding to the tips of fingers, are consequent on holding a plate by the hand spread under it. The warmth of the fingers causes more rapid evaporation of the collodion. If the plate is very large, a stout piece of cardboard placed between the fingers and the plate will remedy the evil. (6). *Diagonal streaks and ridges* appear when the plate is insufficiently rocked, and (7) *Circular wave-like ridges* when the collodion is thick, or the plate not rocked when drying. (8). *Air-bubbles* appear as little holes with tails, or as lumps marking the course they have travelled. Do not hold the pouring bottle too high, and don't agitate it. (9). *Irregular black spots* are specks of dust from the pouring bottle, or dust from the atmosphere. (10). "*Comets*" sometimes make their appearance when the collodion is freshly iodized, or not settled. (11). *White and black lines* also evidence collodion insufficiently settled. Filter. (12). "*Shingle*" *marks* sometimes appear in cold weather, and where water is present in the collodion. (13). *Slipping of the film*—Bad sample of gun-cotton in the collodion, or it may be an unclean plate. (14). *Veils* from an alkaline collodion: remedy, add iodine. (15). *Honey-combed structure* of the film, where the collodion is too tough. (16). *Insensitiveness* results from using collodion of too great age. Mix it with some of new preparation. (17). *Many defects* are caused by using the pouring bottle for the reception of the drainings from the plates. For defects caused by the iodides, bromides, &c., of the collodion, *see* IODIDES, BROMIDES, ETC., USED IN COLLODION, DEFECTS DUE TO.

COLLODION, FILTERING. During this operation, the filter should always be covered by a glass plate to prevent as much as possible the evaporation of the alcohol and ether.

COLLODION NEGATIVE PROCESS, consists of eight operations:—
1. *Cleaning the glass plate.* (*a*). Rinsing the plate free from straw, dirt, &c. (*b*). Place in nitric acid. (*c*). Thoroughly wash. (*d*). And, while still wet,
2. *Albumenize.* (*a*). Wash thoroughly (*b*). Coat with albumen. (*c*). Stand in rack, all the albumenized surfaces one way. (*d*). Allow of spontaneous drying. 3. *Coating the plate with collodion.* (*a*). Brush the albumenized surface free from any specks of dust. (*b*). Coat with collodion. (*c*). When the film receives impression of the ball of a finger without tearing, place the plate in the sensitizing bath. Shut the door. 4. *Sensitizing the film in the nitrate of silver bath.* (*a*). Note when greasy lines on the film disappear, then let the plate rest one minute. (*b*). Remove the plate. (*c*). Drain off surplus silver on clean bibulous paper. (*d*). Place in holder. (*e*). Closing door of dark slide. 5. *Exposure.* (*a*). Secure exact focus. (*b*). Cap the lens. (*c*). Remove focussing glass. (*d*). Substitute holder. (*e*). Opening

dark slide. (*f*). Uncapping the lens. (*g*). Making proper exposure. (*h*). Capping the lens. (*i*). Shutting dark slide. (*j*). Removing holder to dark room. (*k*). Shutting the door. (*l*). Taking out the plate. 6. *Development*. (*a*). Developer ready to hand. (*b*). Pouring developer over the plate steadily, and without loss of free silver. (*c*). Arresting the action when all detail has appeared. (*d*). Thorough washing. (*e*). Intensification if necessary. (*f*). Thorough washing. 7. *Fixing, washing, and drying*. 8. *Varnishing*. (*a*). Warming the plate gently. (*b*). Pouring on the varnish. (*c*). Rocking the plate to prevent ridges. 9. *Preparation of the negative for printing*. (*a*). Producing matt surface for retouching. (*b*). Retouching. Operations 3, 4, 5, and 6 are conducted in the dark, *i.e.*, in a place free from actinic light. Explanations of these different operations will be found under their distinctive headings.

COLLODION NEGATIVE PROCESSES, FAILURES IN. *See* under the distinctive headings, as ALBUMENIZING, FAILURES IN, &c.

COLLODION POSITIVES. Pictures on a collodionized surface, produced without any subsequent printing operation, by developing the image obtained in the camera. The lights of the picture being those portions of the film rendered opaque by the action of lights and the darks, a black backing of varnish seen through the transparent or untouched parts of the film. *Positives on Glass*. The glass must be perfectly transparent, flat, and free from flaws and cut to the size of the plate-holder. The edges are then filed and the plate cleaned, and (it were well) albumenized, *q.v.* (1.) The collodion should be one giving a rich creamy opaque film, the bath about forty grains to the ounce. (2.) Expose about half the time required for a negative. (3.) The development with solution of 1 ounce protosulphate of iron, 1 ounce acetic acid to 16 ounces of water, should not be continued further than to bring out the lights; roughly speaking, about half the time being expended as for developing a negative. Wash very thoroughly. (4). Dry and varnish; any *clear*, *colourless* varnish being suitable. (5). The background is formed by some black substance, as paper, velvet, varnish, &c., either on the collodion or glass surface. If on the glass side the picture is laterally inverted; on the collodion side this defect is avoided, but at some expense of brilliancy and effect. The pictures are preserved in little ornamental frames. *To colour* positives, fine clay powders are laid on the whites of the picture with a fine camel's-hair pencil. These tints lie on the surface of the picture, and do not penetrate the material of the film. By the *Alabastrine Process* the film is made permeable to varnish, and thus to exhibit the colour through the film without destroying the purity of the white. To accomplish this, while the film is still moist after fixing, pour upon it a quantity of the following solution:—Sulphate of the protoxide of iron, 20 grains; bichloride of mercury, 40 grains; chloride of sodium, 15 grains; water, 2 ounces. Keep the plate in motion, and add fresh solution until the whites are perfectly clear. As heat aids the action, it is well to keep moving a small flame under the glass, but the solution is not allowed to dry. When the operation is complete, wash thoroughly, dry and varnish, colour and re-varnish. The picture is then backed on the collodion side with black velvet—never with the black varnish, which would injure the film. *The Melainotype and Ferrotype* are pictures taken on thin sheet iron plates varnished on both sides, one being specially and more carefully prepared as the backing of the picture. Rich black, brown, purple, blue, and other colours have been adopted, the first two named being now generally used. The process affords greater durability, and does away with some of the operations of the glass positive process, but is similar in working.

The image is reversed. *Positives on Purple Glass* do not require a backing of varnish, the colour of the glass forming an excellent background to the picture. *Positives on Paper or Card.* The paper or card is first gelatinized by floating the side on which the picture is to be taken on a warm strong solution of gelatine, and dried. Attach to glass by an edging of wax. Black varnish the surface of the paper, and let it dry. Proceed as with the glass picture. To remove from the glass, cut round the edges with a penknife. *Positives on Glazed Canvas, Patent Leather, &c.* Attach to glass by waxing the edges, as just described, and without using the black varnish take the positive on the glazed surface.

COLLODION POURING BOTTLES. Tall glass stoppered bottles with a lip, from which the collodion may be poured over the plate. It is better to have two in use, one from which to pour, and the other to receive the surplus collodion. The shape allows of subsidence of all particles of dust, that the clear collodion may be poured off.

COLLODIONIZED PAPER, either plain or coloured, can be painted upon in oil colour, as also may be photographic prints, prepared in like manner.

COLLOID. *See* DIALYSIS.

COLLOTYPE. *See* MECHANICAL PROCESSES.

COLOUR (*Lat.* and *Fr.*) In art photography, the brilliancy in skillful unity of lights and darks, which forms the antithesis to flatness and weakness of the image.

COLOUR. In Physics, a property inherent in light, which, by a difference in the rays and the laws of refraction, gives to bodies particular appearances to the eye, produced, it is supposed, by the body absorbing all the coloured rays, which, when combined, produces white light, except the rays of the particular colour it emits. The principal colours are red, orange, yellow, green, blue, indigo, and violet; white is not properly a colour, as a white body reflects the rays of light without separating them; black, on the contrary, absorbs nearly all the rays, and is therefore no distinct colour. In common discourse, however, both are denominated colours.

COLOUR, ABSORPTION OF. *See* LIGHT.

COLOUR, EFFECT OF, in photography. Means have not yet been devised for the faithful representation of colours by shade, *i.e.*, as they would be produced by an etcher in black and white. We find, roughly speaking, that blues and violets appear lighter, and yellows and reds darker, in a direct or printed positive, than they should be, and that other colours suffer misrepresentation to a certain extent.

COLOUR OF THE FILM. The colour of the film exercises a great influence on the printing qualities of the negative; the olive-tinted film producing the finest results. Though nothing is definitely known of the causes bringing about this colour, the writer has observed it where cyanide of potassium was used in the fixing of the negative, either in conjunction with hyposulphite of soda, or alone.

COLOURING PHOTOGRAPHS. A branch of art for which special artistic training is absolutely necessary. As the subject would require for itself a volume, the slight instruction which only could be given in this place would be mischievous.

COMBINATION (*Fr.*), in Chemistry, denotes the intimate union of two or more bodies of different natures, from which a new compound results, differing in its nature from either of the constituents.

COMBINATION PRINTING. *See* PRINTING, COMBINATION.

COMBUSTION. In Chemistry, a term denoting the decomposition of certain substances accompanied by light and heat.

"COMETS." *See* COATING THE PLATE, FAILURES IN.

COMPLEMENTARY COLOURS (*Lat.*) Those which are in the greatest degree opposed to one another, and which, therefore, when mixed together, produce white light or neutrality. The

following are the principal colours and their complementaries: red, green; orange, blue; yellow, violet.

COMPOSITION (*Fr.*) In Art, the putting together the several parts of a picture, so as to set off the whole to the best advantage.

COMPOSITION. In Chemistry, the combination of different substances, from which results a compound substance differing in properties from either of its component parts. Thus, water is a composition of hydrogen and oxygen, which are invisible gases.

CONCAVE (*Lat.*) Hollow, as the inner curve of an arch.

CONCAVE LENS, DOUBLE. A lens bounded by two concave spherical surfaces, which causes parallel rays of light to diverge. If the radii of its curvatures are alike, it is said to be equally concave; but if otherwise, unequally concave.

CONCAVO-CONCAVE. Hollow or concave on both sides.

CONCAVO-CONVEX. On the one side concave, and on the other convex.

CONCRETE (*Lat.*), in Natural Philosophy, signifies a body made up of different principles, or any mixed body. Thus, soap is a factitious concrete, or a body mixed together by art.

CONDENSE (*Lat.*) Diminish the bulk without diminishing the weight.

CONDENSER. A thick convex lens, or pair of lenses in contact, used for directing rays of light through any transparent, or upon any solid, object intended to be copied.

CONGEAL (*Lat.*) To turn from a fluid to a solid state by cold.

CONICAL BACKGROUND. *See* BACKGROUND.

CONJUGATE FOCUS. *See* FOCUS.

CONTACT (*Lat.*) Close union: joining one body to another.

CONTOUR (*Fr.*) In the Fine Arts, the outline, or that line which defines or terminates a figure.

CONTRAST (*Fr.*) In Photography, &c., the due placing of the proper parts and objects of figure, that they may be suitably opposed to each other; also as regards the distribution of light and shade.

CONVERGE (*Lat.*) Tend to one point from different places.

CONVEX. Swelling or rising on the exterior into a spherical or round form.

COPPERAS. Sulphate of Iron (*q.v.*)

COPYING. For copying generally, exactness is required. A stand, with a movable board, at perfect right angles, on which the photograph, picture, print, &c., may be fixed, should be provided. Guides also for the camera should be fixed. A rather old collodion is best, although rather slow in working. *Photographs* should be waxed, retouched, and burnished, and copied in diffused light, or, if possible, with strong reflected light from both sides; but this is not often to be secured. Sometimes it is best to place glass over the surface. *Fine line engravings* are best copied in diffused light; give plenty of time, and fix with cyanide of potassium. *Daguerreotypes* should be first cleaned, which may be done in this manner:—Dip the plate for a few moments in clean water, evenly wetting the plate; take in a graduated measure a piece of cyanide of potassium about the size of a marble, and without waiting for it to dissolve, pour the solution on and off the plate until clean. Wash thoroughly, and dry over a spirit lamp. *Daguerreotypes, ambrotypes, and ferrotypes* are best copied in the sun, care being taken that direct rays do not fall on their surfaces, or reflections be cast on the lens. *Oil paintings* require treatment varying according to their character.

COPYING CAMERA. The chief desiderata are rigidity and length of bellows. The least vibration in the box would cause a blurring of the image. For general purposes, a strong camera, with a cone for the lens fitted in front, will do; but where much copying is done, a special camera is required. The front should be fitted with grooves to hold the boards on which lenses of different character are screwed.

COPYING LENS. Flatness of field and freedom from distortion are abso-

lutely necessary for copying. Rapidity is not a very great consideration. Generally it is inadvisable to use any lens to its full power for the purpose of copying. It is an excellent plan to have lenses used for copying—indeed, every lens—fitted to boards of uniform size, so that change of lens entails no trouble or loss of time, and the wear and tear of screw-threads is materially reduced.

COPYING STAND. The best form of stand is a narrow table, fitted at one end with a stout upright bar at perfect right angles with the table; on this bar is fitted a flat square board which may be moved up and down as required, and fixed with a spring or screw. By this means the picture to be copied is always on a plane with the camera. Grooves running the entire length of the table, between which the camera may be moved, fix the position of the lens of the copying camera always directly in front of the centre of the board.

CORROSIVE SUBLIMATE. Chloride of Mercury (*q.v.*)

CORUNDUM. *See* ADAMANTINE SPAR.

COTTON. Consists of almost pure Cellulose. As imported, it is not suited for the manufacture of Pyroxyline, but must be thoroughly combed and cleansed from all impurities. The impurity is a coating of resinous or oily matter, derived from the seed pod, adhering to the fibre, which should be saponified by boiling the cotton in a very weak solution of potash, and washed out by abundant washing. The cotton must be thoroughly dried before immersion in the mixed acids. *See* PYROXYLINE.

"CRAWLING" OF DEVELOPER. *See* DEVELOPMENT, DEFECTS IN.

CRAYON (*Fr.*) A general name for all mineral substances used in designing or painting in pastel.

CRIBRIFORM (*Lat.*). The appearance of intersecting diagonal lines, like network, a paper negative sometimes presents when viewed by transmitted light, produced by the wire grain in which the paper is made. Sometimes more marked by an insoluble precipitate, formed by the developer. Immersion in a bath of dilute muriatic acid will remove this precipitate, and long immersion in almond oil will render the paper even and transparent.

CROSSED LENS. In a single convex lens, the surfaces of which have radii of different lengths, there is the least spherical aberration when the most convex side is presented to a cylindrical pencil. When the refractive index of the glass is 1·5, the radii of the surfaces should be as 1 : 6, and the most convex side presented to the origin of light. This lens has the least spherical aberration of all single lenses, and is called the "Crossed Lens."

CROWN GLASS. *See* GLASS.

CRUDE (*Lat.*) Unprepared.

CRYSOTYPE. An old process in which the image formed on paper prepared with ammonia-citrate of iron was developed by floating the paper on a dilute solution of neutral chloride of gold.

CRYSTALLOID. *See* DIALYSIS.

Cu. The chemical symbol of copper (*Cuprum*).

CUNEIFORM (*Lat.*) Wedge-shaped.

CUPREOUS (*Lat.*) Resembling, or partaking of, the qualities of copper.

CURTAIN (*Lat.*) *See* ACCESSORY.

CURVATURE OF THE FIELD. It will be observed that when the centre of the field has been focussed, the outer portions of the image appear indistinct, whilst if the glass be pushed in to put in focus the outside portions, the centre becomes indistinct. The defects due to curvature might be, and have been, remedied by curving inwards the surface of the sensitized plate, but other disadvantages arise. The image itself must be flattened out, which is effected by the use of diaphragms (*q. v.*)

CUTTING PRINTS. It is advisable to do this before toning. To properly cut prints requires a considerable amount of taste and skill: first, that the picture is cut with due regard to the figure; and, second, that the cutting is clean and straight. In placing the glass over the

picture, see that it is upright, that the figure may not have the appearance of falling, and that it is neither too much to the right or left, too high or too low. With knife or scissors care should be exercised in holding them so that the edges do not wear themselves out against the glass.

CYANIDE OF POTASSIUM, Etc. *See* Potassium, Etc., Cyanide.

Cyanides. Compounds of cyanogen formed on the hydrogen type. Although cyanogen itself is a compound, it acts exactly like an element. The cyanides used in photography are those of potassium and silver, *q.v.*

CYANOGEN (*Gr.*) A gaseous compound of carbon and nitrogen, of the formula CN. It is a colourless, very heavy gas of a peculiar suffocating odour. In its chemical character it closely resembles an element of the chlorine group, and on this account it is generally designated by the symbol Cy.

CYANOTYPE. Processes discovered by Sir John Herschel, in which he used cyanogen. (One of them is given below.) A piece of paper washed with a solution of ferrid-cyanide of potassium (red prussiate of potash) and dried, is of a yellowish colour, and highly sensitive to light. By sufficient exposure, either in the camera or pressure-frames, the salt is converted into Prussian blue in those parts acted upon by light. To fix the picture, the paper is soaked in water, then in a weak solution of carbonate of soda, and dried. Before washing, the shadows of the photograph are of a lavender tint on a yellow ground, but after washing, of a deep blue tint on a white ground. The Prussian blue is, however, not a permanent substance.

DADO, the die, or that part in the middle of the pedestal of a column between its base and cornice. Also the name of a lower part of a wall, in which application it has been used in photography.

DAGUERREOTYPE. The results of the Daguerreotype process still command so much admiration for their beauty that a slight outline of the method of production cannot fail of interest to the photographic student of today. The manipulation of the process may be divided into five operations, viz.:—Cleaning and polishing the plate; sensitizing; exposing in the camera; developing the image; fixing and finishing. *Polishing the Plate.*—The surface of a copper plate of moderate thickness is coated with a layer of pure silver, by the electrotype or other process, and then polished, or "buffed," until the surface assumes a brilliant metallic lustre. *Sensitizing* is effected by subjecting the plate to the fumes of iodine, until alternately its surface assumes tints of pale, and deep yellow, rose, and steel, the original colour of the plate, and recur in the same order as before, until the deep yellow bordering on rose is reached; the plate is then placed over bromine until it assumes a deep blue steel colour. Return the plate to the iodine for from ten to twenty-five seconds. The iodine obliterates any effect that may have been produced by white light on the sensitive film. *Exposure* in the camera, as regards the time, is a matter of experience, varying, of course, according to circumstances. *Development* is effected by action of mercurial vapour heated to a temperature of about 140° Fah. The development is continued until all detail appears. *Fixing.*—Immerse in a solution of hyposulphite of soda until the steel colour has disappeared; pour filtered rain water from a bottle having a cork into which a glass tube is inserted. Then place the (still wet) picture on a levelling stand, and cover the surface of the plate with a solution of hyposulphite of gold, 1 part in 500 of water. The flame of a spirit lamp is then applied until the liquid boils. The image becomes whiter, and gains in force.

Daguerreotype, to Clean. *See* Copying.

DALLASTYPE. *See* Mechanical Processes.

DAMMAR. A white resin, soluble in benzole, and used in varnishes.

DARK ROOM. The chamber in which certain operations of photography requiring the exclusion of actinic light are conducted. Dark rooms for the wet plate process are generally now quite light; it matters little how much light there is, so long as only that of an orange yellow cast is admitted. The chief requirements of a good dark room are: ease of access, space, good ventilation, and handy arrangement of the interior. A gas jet and warming apparatus for winter should be fitted. The walls and shelves should be painted, that they may be easily cleaned. Under the window (glazed with orange yellow glass) should stand the tank, over which the tap, with a plentiful supply of water, is fitted. Here the development is conducted, the light from the windows permitting examination of the plate, and the water is handy for washing the film. Keep the dark room free of everything but what is absolutely necessary for use—glass plates, a brush, collodion, baths, plate holders, developing solutions and utensils, intensifying solutions and utensils, fixing bath, and varnish. Keep the dark room scrupulously clean, and free from dust. Mop out, instead of sweeping, every morning. For some of the more sensitive of the dry plate processes, the window must be glazed with two or even three thicknesses of the darkest ruby glass.

DARK TENT. A portable dark-room for manipulations in the field. The chief requisites are lightness, and, when fixed, steadiness, and convenience of interior accommodation. The dark-tent should be tested before use on an expedition, by placing in it a sensitized plate for a minute or so, and developing to see if any light creeps in when closed. So many excellent tents are sold that mention of any particular form would be invidious.

DECANTING (*Fr.*) Allowing the impurities of a liquid to precipitate, and gently pouring off the clear liquid without disturbing the impurities.

DECIGRAMME. One-tenth of a gramme. *See* METRIC SYSTEM.

DECILITRE. One-tenth of a litre. *See* METRIC SYSTEM.

DECIMETRE. One-tenth of a metre. *See* METRIC SYSTEM.

DECOCTION (*Lat.*) The boiling a substance in water, or other liquid, for the purpose of extracting its soluble constituents. Or, the solution prepared in this way.

DECOMPOSITION. Process by which a compound substance is resolved into its elementary parts. *Double Decomposition*, the mutual interchange of the atoms of two compounds.

DECOMPOSITION OF LIGHT. When a ray of light passes through a prism, it is decomposed into rays of different refrangibility and colour. *See* SPECTRUM.

DEFECTS IN THE NEGATIVE. *See* under each manipulation.

DEFECTS IN THE PRINT. *See* under each manipulation.

DEFLECTION (*Lat.*) In Optics, when a luminous ray passes very near an opaque body, it is deflected or bent from its rectilinear course towards the surface of the body, and the deflection is greater as the distance of the ray from the body is less.

DELINEATION (*Lat.*) Strictly speaking, the sketch or outline of a work; but now often improperly used to express the amount of detail in photograph or work of art.

DELIQUESCE (*Lat.*) To become liquid (or show tendency to do so) from the mere moisture of a damp or ordinary atmosphere.

DENSITY (*Lat.*) Opacity; closeness of constituent parts; that property in bodies by which they contain a certain quantity of matter under a certain bulk or magnitude. As an attribute of the negative, opposed to thinness.

DEOXYDATE, OR DEOXIDIZE. Reduce from an oxide; deprive of oxygen.

DEPTH OF FOCUS. *See* FOCUS.

DESICCATE (*Lat.*) Dry up; exhaust of moisture.

DESULPHURATION. The act or process of depriving of sulphur.

DETAIL (*Fr.*) An attribute of the

negative expressing the minutiæ of parts of the object or scene portrayed, and the fulness of light and shade.

DETERMINATION (*Fr. and Lat.*) In Physics, the tendency of a body in a certain direction.

DEVELOPMENT (*Fr.*) A term generally used in photography to express the process of bringing out the invisible image formed in the camera, by means of ferrous sulphate (protosulphate of iron), for the wet process; and pyrogallic acid for the dry. There are also processes of positive printing where development is resorted to. *See* PRINTING BY DEVELOPMENT. Taking the wet plate, we may thus briefly describe the process of development. The plate having been exposed in the camera, it is removed to the dark room. Here all actinic light being excluded, the plate is removed from the holder. Take the left hand bottom corner of the plate between the thumb and first finger of the left hand, and the developing measure containing a sufficient quantity of solution in the right hand. With a steady even flow send the solution from the right hand bottom corner to the top, round to the left, then to the bottom corner held by the operator, and finally to the corner on which the developer was first poured—and this without spilling any of the solution. When the plate is quite covered, it should be steadied, and the development watched quietly. The little change of position in the plate to make the developer cover the surface is all that is necessary. The agonized wriggling of the plate by some operators is not only a waste of labour, but in it a great deal of free silver necessary to the formation of the image is lost. The following is a good serviceable developing solution:—Protosulphate of iron, 1 ounce; glacial acetic acid, 1 ounce; water, 16 ounces. Alcohol should only be added when the sensitized film repels the developer. It will be noticed in this and other formulæ for developers that an acid (generally acetic) is added. This is to restrain the action of the iron, which otherwise would instantly precipitate the silver all over the film on lights and darks alike, and "fog," *q.v.*, the plate. With an acidified solution, however, the silver is deposited regularly, the particles of metallic silver being attracted by those portions of the film affected by light and the metallic image built up. Heat increases the rapidity of chemical action, so that in hot weather a larger proportion of acetic acid is required to restrain the activity of the developer.

DEVELOPMENT, ALKALINE. *See* ALKALINE DEVELOPMENT.

DEVELOPMENT, DEFECTS IN. (1.) *An opaque spot* at the place where the developer has been poured on the plate is caused by the precipitation of the free silver, and evidences the too violent pouring on of the solution. (2.) *Curved lines* are formed by the developer when it is not poured evenly and steadily over the film, each stoppage causing a line or mark. (3.) *Curved lines* may also be caused by water left in the developing glass, not having mixed with the developing solution, and causing delay of action on those parts on which it rests. (4.) "*Crawling*," *i.e.*, when the developer does not flow evenly over the film, but is repelled as by a greasy surface, is generally caused by an excess of alcohol and ether in the bath. Remedy, drive off the excess from the bath by heat, or add alcohol to the developer. (5.) "*Crawling*" may also be due to an excess of alcohol in the developer. (6.) "*Fog*" may be caused by too strong a developer; or one of insufficient strength. (7.) "*Fog*" is often caused by a lack of acid in the developer. (8.) *Flatness, and lack of contrast*, may be the effect of over-development, and, as conducing to it, the use of too strong a developing solution. It may, however, arise from the bath, the collodion, bad lighting, or from over-exposure. (9.) *Harshness, and want of detail*, follow when development is prematurely arrested, or from an inactive developer. The fault may, on the other hand, be with the collodion, the lighting, or from

under-exposure. (10.) *Failures of many kinds* are attributable to faulty manipulation. The common habit of "swilling" the plate with a large volume of solution, and washing off the free silver, is to be discommended.

DEVIATION (*Lat.*) When a ray of light is refracted or reflected at the surface of any medium, and follows a different course from that it originally pursued, the angle through which it is turned out of its original course is called its deviation.

DEW (*A.S.*) When a body gradually cools in a moist atmosphere—as, for instance, when a lump of ice is placed in water contained in a glass—the layer of air in immediate contact cools also, and a point is ultimately reached at which the vapour present is just sufficient to saturate the air; the least diminution of temperature then causes a precipitation of moisture on the vessel in the form of dew. When the temperature rises again the dew disappears. The

DEW POINT is the mean of these two temperatures. If a cold lens be taken into a warm air it becomes covered with dew, and this produces fogginess and indistinctness in the picture. The temperature of the lens at the time of using it should be above dew point.

DEXTRINE (*Lat.*) British gum. Starch carefully heated until vapour rises, loses its gelatinous character, and becomes soluble both in cold and hot water. It has the property, when acted upon by polarized light, of turning the plane of polarization to the right; hence its name dextrine from the Latin *dexter*, right. It is of a pale buff colour, insoluble in alcohol, and is a valuble substitute for gum.

DEXTROSE. *See* GLUCOSE.

DIACTINIC (*Gr.*) Transparent to the actinic or chemical rays of light.

DIAGONAL (*Fr. & Gr.*) A right line drawn across a quadrilateral figure from one angle to another; sometimes called the diameter of the figure.

DIALYSER (*Gr.*) The septum or dividing film of parchment paper, used in the operation of dialysis, *q.v.*

DIALYSIS (*Gr.*) It has been found that solutions of certain bodies pass through membranes with considerable facility, and others pass very slowly. Those of the former class embrace crystalline bodies (such as metallic salts), and organic bodies (as sugar, morphia, and oxalic acid); those of the latter class consist of bodies devoid of crystalline power, such as gum, albumen, gelatine, &c. To the first class, consisting of easily diffusible bodies, was given the name of *crystalloid*, and to the other the name of *colloid*. The most convenient dividing film is made of parchment paper, *q. v.*, fixed over a hoop; this is floated on a basin of pure water, and in it is placed the substance to be dialysed. Diffusion commences at once; the crystalloids rapidly pass through and dissolve in the water, and the colloids, for the most part, remain behind. Has been used with great success in the preparation of emulsion.

DIAMETER (*Gr.*) A line which, passing through the centre of a circle or other curvilinear figure, divides it into equal parts; hence we have a method of describng a semicircle upon any line, assuming its middle point for the centre. The diameter of a circle is to the circumference as 7·22. The square of the diameter multiplied by ·7854 is the area. The cube of the diameter multiplied by ·5236 is the solid contents of a sphere.

DIAMOND (*Fr. & Lat.*) The glazier's tool for cutting glass should find a place in every gallery. Sometimes when one of those little accidents which should not, but do, happen—as when a plate, after being sensitized, is found to be too large for the holder—much time, trouble, and expense are saved by being able to cut off excess.

DIAPHANIC OR DIAPHANOUS (*Gr.*) A term applied to bodies which, like porcelain, permit the light to pass through their substances. It is the synonym of translucent.

DIAPHANOSCOPE. A dark box in which transparent negatives are viewed, either with or without a lens.

DIAPHRAGM (*Gr.*) A partition of metal or cardboard, having a hole in the centre, placed in the lens, or, in some cases, in front, for the purpose of preventing the action of certain rays. Though useful for the correction of spherical aberration, it is effected at the expense of light; so that the smaller the diaphragm used, the better and "sharper" the focus, but the exposure is necessarily extended from the loss of light. Sometimes known as a "stop."

DIAPOSITIVE. *See* TRANSPARENT POSITIVE.

DIATHERMANCY (*Gr.*) A term used by Melloni to express the power which bodies have of transmitting heat. Diathermancy bears the same relation to radiant heat that transparency does to light. Its antithesis, athermancy, or the power of stopping radiant heat, corresponds to opacity for light.

DICROISM (*Gr.*) A property of certain crystallized bodies of appearing under two distinct colours, according to the direction in which the light is transmitted through them.

DIFFRACTION, OR INFLECTION, in Optics, is the bending of rays of light caused by the unequal thickness of any medium.

DIFFUSE (*Lat.*) Spread, scatter, disperse.

DIFFUSED LIGHT. The general, and to a *certain extent* undirected, illumination of an object in a photographic glass house. It plays the most important part in what is termed "lighting," *q.v.*

DIFFUSED LIGHT in the camera, plate-holder, or dark room, causes fogging.

DIMENSION (*Lat.*) The measure or compass of a thing. A line has one dimension—its length; a superficies two—length and breadth; a solid three—namely length, breadth, and thickness.

DIMORPHISM (*Gr.*) Difference of form with identity of composition.

DIOPTRICS. The science of refractive vision; or that part of Optics which considers the different refractions of light in passing through different mediums, as air, water, glass, &c.

DIPPER. For holding the collodionized plate during its immersion in the sensitizing solution; made of silver wire, glass, porcelain, or gutta-percha. The use of the last-named is to be discommended.

DIRECT LIGHT in illuminating the photographic subject is introduced for the purpose of lighting up the prominences, and for the production of "high lights." Direct light gives life, force, and vivacity to the illumination *See* LIGHTING.

DISHES of glass, porcelain, earthenware, gutta-percha, and asphalted wood are used for sensitizing, washing, toning, and fixing prints, and sometimes for sensitizing and fixing negatives. For the silver solutions glass dishes are preferable, porcelain being liable to surface fracture, gutta-percha thoroughly unreliable, and the purity of asphalt being always open to suspicion. Dishes once used for hyposulphite of soda should be retained solely for that service.

DISINTEGRATION. In Chemistry, the act of separating integrant parts of a substance, mechanically, rather than chemically. Crumbling. Distinguished from decomposition, or the separation of constituent parts.

DISPERSION (*Lat.*) In Optics, the separation of the different coloured rays, in refraction, owing to their different refrangibilities.

DISSOLVING VIEWS. *See* MAGIC LANTERN.

DISTANCE (*Lat.*) An Art term to express the line of objects in a landscape, &c., farthest from the eye, forming a background to the scene; and the artistic representation in a picture to secure the appearance of remoteness, by observance of the rules of perspective, and aerial effect. *See* AERIAL.

DISTILLATION (*Fr. & Lat.*) The vapourizing by heat of liquids in a retort or still, and subsequent condensation by cold in a receiver.

DISTORTION. Where the image formed by a lens on the focussing-screen of a camera does not satisfy the

conditions imposed by the rules of perspective. All lenses in greater or less degree give a distorted image, and to correct this, as far as possible, the diaphragm, *q.v.*, is introduced.

DISTORTION often comes of exaggerated contrast.

DIVERGENT (*Lat.*) Tending to various parts from one point. In Optics, those rays are said to be divergent which, going from a point of the visible object, are dispersed, and continually depart one from another, in proportion as they are removed from the object.

DIVISIBILITY. That property by which the particles of matter in all bodies are capable of separation or disunion from one another.

DOUBLE DECOMPOSITION. *See* DECOMPOSITION.

DOUBLE IODIDE. A solution of two iodides.

DOUBLE OUTLINES IN THE NEGATIVE. *See* EXPOSURE OF THE PLATE, FAILURES IN.

DOUBLE REFRACTION. A property of a large number of crystals, in virtue of which a single incident ray, in passing through any one of them, is divided into two, or undergoes bifurcation, whence it follows that, when an object is seen through one of these crystals, it appears double.

DOUBLET. The style of a lens for views and copying.

DRACHM (*Lat. & Gr.*) One-sixteenth of an ounce avoirdupois, and one-eighth of an ounce apothecaries' fluid measure. *See* WEIGHTS AND MEASURES.

DRAGON'S BLOOD. A resinous juice; sometimes used to tinge varnishes.

DRAPERY (*Fr.*) In Art, the representation of clothing of human figures, also hangings, curtains, tapestry, &c., introduced into a picture. The lines of drapery exercise an important influence on the composition.

DRAWING. A term in Art, as, "in perfect drawing," to express the proper artistic representation of objects on a flat surface, their form, texture, situation, distance, &c.

DRAWING PAPER. Sometimes used for plain prints. *See* PRINTING, PLAIN.

DRESSING ROOM. In every gallery a chamber should be set apart for the use of customers, wherein they may make such alterations in their toilet as may be necessary.

DROPPING BOTTLE. A small bottle by which liquids may be poured in drops. The most convenient form is that of a piece of glass tube fixed into a cork and fitted at one end with an india-rubber teat. The end of the tube in the bottle should nearly approach the bottom of the bottle.

DROP SHUTTER. A mechanical contrivance for the control of rapid exposures. It may either be fitted inside the camera, in front of the plate, or to replace the cap of the lens.

DRYING OVEN. A small oven in which negatives are dried before and after varnishing. It is grooved for the reception of the plates. A gas jet underneath communicates the necessary heat.

DRYING PAPER. The sensitized paper should be dried pretty briskly over gas jets or a stove. When the paper is removed from the sensitizing bath it is suspended over it to drain; and when free from all surface moisture, hung by clips over the heating apparatus, gas or stove.

DRYING PAPER, FAILURES IN. (1) *The paper curls.* Weight down the lower edge with a stick attached to clips. (2) *Tear-drops in drying* should be blotted off. (3) *Stains* are caused by the sheets sticking together. (4) *Metallic stains* from the gas. Place over the jets a sheet of zinc. (5) *Numerous failures* arise from imperfect drying—over-drying and unequal drying.

DRYING ROOM FOR PAPER. A room set apart for the drying of sensitized paper. It is fitted with a rack to which are attached clips to hold the paper over a row of gas jets or a stove. The gas or stove should be lighted half an hour or so before the paper is ready for drying.

DRY PLATE PROCESSES WITH THE BATH, consist of six operations:—1. *Preparation of the plate.*—Clean the plate, first, by soaking it in potash, then in nitric acid, and edge or coat with a substratum, *q.v.*, of albumen, india-rubber, or gelatine. 2. *Coating the plate with collodion, q.v.* 3. *Sensitizing in the bath* (or it may be coated with a collodion having the sensitive salts in suspension. *See* EMULSION PROCESSES). The plate is then washed in distilled or purified water. Two dishes are filled with water, and immediately the plate is removed from the negative bath it is immersed without stoppage in one of the dishes, and when all greasiness is removed from the film, the plate is placed in the other bath of water and left for four or five minutes, then rinsed with distilled water, and coated with the preservative, *q.v.* This may be done by coating or immersion. The plate is then dried—spontaneously, or by heat. Some dry plates are subject to blurring, *q.v.*, to prevent which, the back of the plate is coated with some non-actinic colour, as burnt sienna, gamboge, &c., called a "backing," *q.v.* 4. *Exposure*, in the camera or printing-frame. 5. *Development.*—On the removal of the plate from the dark-slide or printing-frame, it is moistened with water or spirits of wine (whichever happens to be the solvent of the preservative) by pouring evenly, without stoppage, over the film, and the preservative removed. The plate is then developed, washed, and, if need be, intensified. 6. *Fixed, dried, and varnished.*—These manipulations are common to all dry plate processes, and there is, with one exception, little difference to the corresponding operations of the wet plate process. There are, however, three operations unknown in the wet plate process: (*a.*) *Washing the plate after sensitizing*, to eliminate the free silver from the film; and, (*b.*) *Coating with a preservative*, which is removed before developing the plate. (*c.*) "*Backing*" the plate.—*Development* is generally brought about by means of pyrogallic acid, but sometimes by iron. We will briefly review the variations in these operations in certain special processes now in use.—— BEER PROCESS. A simple and convenient process for printing positives for the lantern, &c. The sensitized plates are washed and coated with common ale, and dried. After exposure, wash, and develop with pyrogallic acid.—— COFFEE PROCESS. In ordinary collodion the addition of two grains of bromide of cadmium to the ounce of collodion is recommended. The preservative:—No. 1.—Distilled water (boiling), 5½ ounces; mocha coffee, ½ ounce; white sugar, 90 grains. No. 2.—Distilled water, 5½ ounces; gum-arabic, 90 grains; sugar-candy, 20 grains. No. 1 is allowed to cool, filtered, and mixed wilh No. 2. Coat the sensitized film twice, each of a minute's duration, drain, and dry. Before development, immerse in rain or good ordinary water, and then pour over the plate:—Saturated solution of carbonate of ammonia, 8 drops; water, 4 drachms. This is worked over the plate till the image begins to appear, when the solution is returned to the developing cup, and to it added one or two drops of the following solution:—Pyrogallic acid, 60 grains; alcohol, 1 ounce, and cleanly poured over the plate, as the action is extremely rapid. Wash, and intensify. If it appears transparent the plate should be coated with the following:—Ammonia sulphate of iron, 45 grains; copper sulphate, 45 grains; citric acid, 45 grains; water, 3½ ounces. After the first application, two or three drops of a 20-grain solution of nitrate of silver may be added. Again intensify. Wash, and fix as usual.——COLLODIO-ALBUMEN PROCESS. The sensitized plate is washed, and twice coated with albumen, 8 ounces; ammonia, 2 drachms; iodide of potassium, 50 grains; bromide of potassium, 10 grains; water, 2½ ounces, fresh solution being used each time. The salts are first dissolved in water, the ammonia added, and the solution mixed with the albumen; the whole beaten into a froth, allowed to settle, decanted, and

filtered. The plate is slightly drained, and set up to dry. Before use the plates must be re-sensitized in a 30-grain bath acidified with ½ drachm of acetic acid to the ounce. The plate is washed and dried. Exposure, at least ten times that of an ordinary wet plate. Develop with pyrogallic acid, three grains to the ounce. The density may be brought up by the use of the following: Pyrogallic acid, 2 grains; citric acid, ½ grain; water, one ounce, to which four drops of a 30-grain nitrate of silver solution have been added.—— GUM-GALLIC PROCESS. To ordinary good collodion should be added a grain per ounce of bromide of cadmium. Coat, sensitize, and wash, and apply the following preservative:—No. 1. Gum-arabic, 20 grains; sugar-candy, 5 grains; water, 6 drachms. No. 2. Gallic acid, 3 grains; water, 2 drachms. No. 2 is prepared by the aid of heat, and added, in the proportion indicated, to No. 1. The plate is then drained, and allowed to dry spontaneously. Exposure rarely less than four times that for a wet plate. The acid iron developer is sometimes used:—No. 1.—Gelatine, 64 grains; glacial acetic acid, 2 ounces; water, 14 ounces. No. 2.—Proto-sulphate of iron, 30 grains; water, 1 ounce. In preparing No. 1, the gelatine is soaked in half the water until it is thoroughly swelled. The other half of the water is added in a boiling condition, the acetic acid added, and the whole allowed to cool. One part of No. 1 is mixed with three parts of No. 2, as required for use in one or two days. Before developing, the plate is immersed in water of not less than 65° Fahr. for two or three minutes, to soften the gum, then rinsed under the tap. The plate is then developed, and intensity gained by the ordinary pyro intensifier. The alkaline developer given under the TEA PROCESS may be used with a gain of rapidity to the process.—— MORPHIA PROCESS. Sensitize for three minutes a plate coated with bromo-iodized collodion; wash, and immerse in the following solution:—Acetate of morphia, 15 grains; water, 17 ounces. Dry, and expose twice as long as a wet plate. Develop with pyrogallic acid. Intensify and fix as usual.—— TANNIN PROCESS. Coated with a bromo-iodized collodion, and sensitized in a strong bath, the plates are thoroughly washed and coated with—tannin (pure), 10 to 15 grains; distilled water, 1 ounce. Exposure about half as long again as for gum-gallic plates. Develop as in the COFFEE PROCESS.—— TEA PROCESS. The plate is coated with bromo-iodized collodion, sensitized, and after being thoroughly washed it is immersed in an infusion of tea—half an ounce of good black tea over which ten ounces of boiling water have been poured. After standing two or three hours, it is filtered and ready for use. Neither gum nor sugar should be added. The plates, which should be used within two or three days of preparation, require about three times the exposure of wet plates, and should be developed within twenty-four hours afterwards, either by the acid iron developer given under the gum-gallic process, or by the following alkaline developer:—No. 1—6 grains of pyrogallic acid in 1 ounce of water. No. 2—20 grains of bromide of potassium in 1 ounce of water. No. 3—1 part of ammonia (·880) in 32 of water. To every two parts of Nos. 1 and 2, one part of No. 3 is added. To prevent irregularity in development, it is well to flow the plate for a second or two with the mixture of Nos. 1 and 2, before adding No. 3.

DUSTING-IN PROCESS. *See* POWDER PROCESS.

EARTHENWARE. Dishes of earthenware are extensively used in photography, but are not suitable for silver nitrate, as the glaze of the vessel is acted upon by the solution. *See* BATH.

EAU BROMEE. Bromine water; formerly used in the Daguerreotype process.

EBONITE. A hard, ebony-like substance; sometimes used for baths and washing trays. For nitrate of silver it

is not suitable, as, besides being fragile, it is likely to contaminate the solution with sulphur and organic matter.

EBULLITION (*Lat.*) Boiling; also the effervescence which arises from the mixture of an acid and an alkaline liquor.

"EDGING" of albumen, gelatine, or india-rubber is sometimes applied to plates in the emulsion and dry plate processes instead of a substratum, before coating with collodion or emulsion, to secure the film during the subsequent manipulations. Where no edging or substratum has been previously applied, an edging of india-rubber is given to the film before developing. The liquid is lightly brushed round the border of the plate (or film) with a twisted piece of paper or a brush. *See* DRY PLATE and EMULSION.

EFFECT (*Lat.*) In Art, generally used to express completion, perfectness. "Semblant art shall carve the fair effect."

EFFERVESCENCE (*Lat.*), in a general sense, signifies a slight degree of ebullition in liquids exposed to a due degree of heat; also applied to that commotion excited in various fluids, either by their mixture with others of a different nature, or with salts of various kinds.

EFFLORESCENCE. A word applied to the conversion of a compact or crystalline body into a powder; also the spontaneous formation of small white threads, resembling the sublimated matter called flowers, on the surface of certain substances. This is sometimes called *saline vegetation*.

EGG. (*A S.*) Albumen obtained from eggs is largely used in photography. The germ should be extracted. *See* ALBUMEN.

ELASTICITY (*Fr.*) The property some bodies possess of returning to the form from which they have been distorted or displaced. For instance, the air and vapours are elastic, and when the force by which they may be compressed is removed, they instantly expand or dilate, and recover their former state.

ELECTRIC LIGHT. *See* ARTIFICIAL LIGHT.

ELECTROGRAPH. An apparatus constructed by Dr. Brooke to register the declination of the magnetic needle. The magnetic needle carries at its extremity a small mirror, on which the light of a lamp falls, and the reflected ray is thrown upon a piece of sensitized paper in a camera, and it then traces an arc, greater or less in proportion to its distance from the photographic paper. The sensitized paper is attached to a cylinder, which performs one revolution on its axis in twenty-four hours.

ELECTRONEGATIVE. The non-metals, with the exception of hydrogen, are electronegative, or non-basylous.

ELECTROPOSITIVE. Hydrogen and the metals are electropositive.

ELEMENT (*Lat.*), in Chemistry, is merely the last result of chemical analysis, or that which cannot be decomposed by any means now employed. Their number is diminishing. The elements have, for convenience of study and reference, been divided into two great classes, called respectively metals and non-metals, or metalloids. This division is arbitrary, since both classes possess many qualities in common, rendering it very difficult to say which are and which are not metals. *See* METALS and METALLOIDS.

ELEMI. A resin obtained from the *Amyris Elemifera*, of strong aromatic odour, and hot, spicy taste; sometimes used in varnishes.

ELIMINATION (*Lat.*) Getting rid of.

ELLIOTYPE. A process, named after its inventor, for enabling artists to obtain photographic prints from their works. A painting in body colour is made on glass, more or less transparent according to the density of colour and the painting printed from, as a negative.

EMULSION (*Lat.*) A term used in photography to express a collodion, or other viscous body, in which is held in suspension a sensitive salt of silver in minute division. The collodion emulsion may be taken as pure silver bromide held in suspension in collodion,

or gelatine, so prepared that when a glass plate is coated with it the film is homogeneous, and equal in sensitiveness to that secured by the wet process.

EMULSION, PREPARATION OF THE. *Collodion Emulsion.*—A plain collodion is first prepared, and the bromide, dissolved in alcohol, with a drop or two of nitric acid to get rid of any oxide or any other impurity, added. To sensitize, dissolve the silver nitrate in alcohol and a little water by means of heat, and add the silver solution a little at a time to the bromized collodion, stirring thoroughly during and after each addition. If properly mixed the thin film running down the sides of the bottle after agitation will give a deep orange tint to the flame of a candle, viewed through it. By dropping a little of the emulsion on a glass plate, the structure of the film may be judged: and when on this a little potassium chromate is dropped, if the silver be in excess, as is sometimes required, a bright red colour will show. The absence of colour indicates the excess of bromide. Various periods for the ripening of the emulsion are required, according to the bromides used—generally, from twelve to twenty-four hours. If used at this stage, the plate, when coated, is washed, and a preservative poured over it. The general usage, however, is *to wash the emulsion.* Pour it into a flat dish, until a skin forms on the surface; this film is broken up by a glass rod, and at intervals this is repeated until the emulsion begins to break into lumps. It is now washed in several changes of distilled water, or placed in a coarse canvas bag, and immersed in pure water for a quarter of an hour, and then the water squeezed out. This is repeated several times, until the expelled water, when tested for free silver, shows no signs of milkiness on the addition of a drop of hydrochloric acid. The mass is now dried, either spontaneously, by heat, or by covering with alcohol for half an hour, and afterwards draining away the superfluous alcohol. The pellicular mass is next dissolved in the proper proportion of solvents, and in a few hours the silver bromide should be in suspension; but the emulsion is improved by keeping a certain time. The coating qualities should be tested by coating a plate. *Gelatine Emulsion.* The gelatine is soaked in water until it swells, and the bromide dissolved in water, poured upon it, and the whole dissolved by heat, by placing the jar in hot water. To sensitize, dissolve the silver nitrate in water, and pour the solution, little by little, into the gelatine, stirring the while; when mixed, pour the emulsion into a flat dish to set. Break into lumps, and cover with water, and let it stand an hour; change the water, and let the washing continue four or five hours, or until the addition of a drop of silver nitrate solution to some of the wash water in a test tube causes no milkiness, indicating absence of free bromide in the washings; or the washing effected by squeezing once or twice through canvas into water (*see* GELATINO-BROMIDE PROCESS). The gelatine is now thoroughly drained, and the vessel containing it placed in hot water until the whole is dissolved. Alcohol is added, and the emulsion made up to the proper bulk.

EMULSION PROCESSES consist of five operations:—(1.) *Preparation of the plate*, by soaking in nitric acid and potash, and thoroughly washing in water and applying an "edging," *q.v.*, or "preservative," *q.v.*—drying. (2.) *Coating the plate with emulsion*; dried by heat. If a preservative is to be employed, wash the plate until all "greasiness" in the film disappears, and pour over the preservative, and dry. "Backing" the plate, *q.v.*, is, with some kinds of emulsion, necessary. (3.) *Exposure.* (4.) *Development.* The film is moistened by a solution of alcohol and water, and the backing and preservative removed by washing; developed; washed; intensified; and again washed. (5.) *Fixed* in hyposulphite of soda or cyanide of potassium; washed, dried, and varnished (*see* DRY PLATE PROCESSES).—— BEECHEY'S PROCESS. The collodion: Bromide of cadmium (anhydrous), 32

grains; alcohol 1 ounce. Decant carefully after allowing to stand some time, and add 8 drops of strong hydrochloric acid. Of above solution take ½ ounce; absolute ether, 1½ ounce; pyroxyline, 12 grains. To sensitize, dissolve 40 grains of nitrate of silver in an ounce of alcohol. The plate, being prepared with a thin substratum of gelatine or india-rubber in the usual manner, is coated, the emulsion being first well shaken and filtered; when "set," immerse in a dish of distilled or rain-water, and coat with clear, light bitter beer, with one grain of pyrogallic acid to the ounce; or other preservative. In the exposure great latitude is allowable—from thirty seconds to five minutes is common; but under long exposure the bright objects should be screened while the darks are exposed. For under-exposure a strong developer is best. Bromide of potassium (12-grain solution) 15 drops; pyrogallic acid (96 grains to 1 ounce of water), 30 drops; carbonate of ammonia (60 grains to 1 ounce of water), 3 drachms, or, the developer given under Dry Plate (Tea) Process may be generally used.——CHLORO-BROMIDE PROCESS (CAREY LEA'S). Collodion:—ether, 20 ounces; alcohol, 12 ounces; intense pyroxyline 162 grains; bromide of cadmium, 320 grains; bromide of ammonia, 64 grains. Add to the ether half the alcohol, and shake up with the pyroxyline; dissolve the salts in the rest of the alcohol in a flask by heat, add to the other portion, shake, and place in a warm, light place for from three to twelve weeks. Sensitized by the addition of sixteen grains of nitrate of silver to the ounce of collodion (fused nitrate to be preferred), by boiling in alcohol. Keep twenty hours before use. Filter. The tannin preservative with 12 grains each of gum-arabic and sugar (*see* DRY PLATE TANNIN PROCESS) may be used, or the litmus preservative: to prepare which,—cover a quarter of a pound of litmus with hot water, and place in a warm place for a day; throw the paste into a filter and pour on hot water until the filtrate amounts to a quart; add one drachm of carbolic acid. Of this litmus solution take 1 ounce; water, 6 ounces; gum-arabic, 90 grains; fine white sugar, 90 grains; acetic acid (Beaufoy's), 25 minims; in which immerse the sensitized plate until all greasiness disappears. Develop with a 60-grain alcoholic solution of pyrogallic acid, and a 40-grain solution of ordinary carbonate of ammonia in water. Agitate the pan to mix them well; immerse the plate without washing; and to secure density, add another drachm of the ammonia solution. Or the developer given under the Dry Plate (Tea) Process, may be used.——COLLODIO-ALBUMEN PROCESS. Collodion:—alcohol, 4 drachms; ether, 6 drachms; pyroxyline, 16 grains. This is decanted, and to it is added 20 grains of bromide of zinc. Greater density is obtainable by omitting 4 grains of the bromide, and adding 4 grains of chloride of calcium dissolved in a small quantity of alcohol, and enough bromine water to tinge the solution to a very pale yellow. For each half ounce of the above 1 grain of dried albumen is taken and dissolved in the least possible quantity of water, carefully dropped into the collodion, and well stirred up. Forty grains of nitrate of silver are added after being dissolved in the smallest quantity of water possible. The emulsion is next poured into a dish, and the ordinary manipulations carried out. After a couple of washings it may be covered with a weak solution of nitrate of silver until the traces of silver are very faint. The pellicle should be redissolved in equal quantities of alcohol and ether, and finally there should be seven grains of the pyroxyline as originally used, to each ounce of the mixed solvents. Development may be conducted with plain pyrogallic acid, and intensification with pyrogallic acid and citric acid, with the addition of a few drops of a nitrate of silver solution; or by the alkaline developer given under Dry Plate (Tea) Process, &c.——COLLODIO-BROMIDE PROCESS, COOPER'S. Collodion—Ether, 4 ounces; alcohol, 2 ounces; bromide of cadmium, 40

grains; bromide of ammonium, 24 grains; pyroxyline, 40 grains. To sensitize, add to 12 drachms of this collodion, little by little, shaking on each addition, 23 grains of nitrate of silver, dissolved by heat in alcohol; other 12 drachms of the bromized collodion are now added. Filter if necessary. Coat the plate in non-actinic light, and when the film has properly set, immerse in water until all greasiness disappears, when immerse in the preservative: Gum-arabic, 15 grains; tannin, 4 grains; white sugar, 4 grains; distilled water, 1 ounce. Or, tannin, 15 grains; alcohol, 15 grains; water, 1 ounce. Apply a backing to the plate, or aurine, *q.v.*, may be used. For development make up the following solutions: No. 1—Pyrogallic acid, 3 grains; water, 1 ounce. No. 2—Carbonate of ammonia, 1½ drachms; water, 1 ounce; or liquor ammoniæ, 1 part; water, 12 parts. No. 3—Bromide of potassium, 1 grain; water, 1 ounce. Take of Nos. 2 and 3, each a drop in the developing cup; add one drachm of No. 1, and pour over the plate; when the detail appears by reflected light, add one drop of No. 2 to each drachm until sufficient density be secured. If it cannot be gained by this, take one drop of nitrate of silver, 20 grains; citric acid, 25 grains: water, 1 ounce, with one drachm of No. 1. Should the image flash out at once from over-exposure, the developer should be returned to the cup and the plate washed; add extra two drops of No. 3, and proceed with the development. Fix such an over-exposed picture first, and then redevelop. If the image refuse to appear in three or four seconds, make up a fresh devoloper as before, *omitting* the bromide of potassium.——

Gelatino-Bromide Process.—Soak in water, until thoroughly swelled, 40 grains of gelatine (Nelson's), drained, and placed in a jar; 30 grains of bromide of potassium dissolved in 8 drachms of water, and poured on the gelatine, the jar containing which is then placed in hot water until dissolution and mixture are effected. Forty grains of nitrate of silver dissolved in 8 drachms of water are poured little by little into the gelatine, which is well stirred the while. The emulsion is then poured into a flat dish, and allowed to set thoroughly, then broken into little lumps, and washed. After thoroughly draining, the gelatine is dissolved by placing the jar containing it in hot water. Add one drachm of alcohol. To thoroughly free the gelatine of the insoluble salts it may be squeezed through napless canvas into water; the threads afterwards are collected in a calico bag, and the water filtered from them through the calico. The gelatine is then redissolved by heat. The plate to be coated is cleaned, and warmed sufficiently to be pleasant to the touch, and the gelatine first filtered, poured over, and placed on a levelled glass to set, and dried by heat. For development prepare the following: No. 1—4 grains of pyrogallic acid in 1 ounce of water; No. 2—½-ounce of ammonia in eight ounces of water; No. 3—180 grains of bromide of potassium in 8 ounces of water; No. 4—20 grains of gelatine in 10 ounces of water. The plate is first soaked in distilled water for five minutes, when half-an-ounce of No. 4 is added to the water, and the plate left another half minute; drained, and a mixture of half-an-ounce of No. 1 with half-an-ounce each of No. 2 and No. 3 poured over the film. Extra density may be obtained by the addition of one or two drops of No. 2. Fixation in hyposulphite of soda.——

Uranium Process (Wortley's). In 1 ounce of plain collodion, 7 grains of anhydrous bromide of cadmium and 30 grains of nitrate of uranium (very slightly acidified with nitric acid) are dissolved, and 13 grains of nitrate of silver added in the usual manner. The plate should have a substratum, and after being coated with the emulsion is washed in distilled water until greasiness disappears. The usual preservatives may be used, or one made as follows:—No. 1—Saturated solution in distilled water of salicine. No. 2—60 grains of

tannin in 1 ounce of distilled water. No. 3—48 grains of gallic acid in 1 ounce of alcohol. Take 2 ounces of No. 1, 1 ounce of No. 2, and ½ an ounce of No. 3, 40 grains of sugar, and 7 ounces of water, and flow over the plate. Developer:—No. 1—Pyrogallic acid, 96 grains, in 1 ounce of methylated alcohol. No. 2—Bromide of potassium, 12 grains, in 1 ounce of distilled water. No. 3—Carbonate of ammonia, 30 grains, in 1 ounce of water (or, 25 minims of liquor ammoniæ in 1 ounce of water). Of these take 1 part of No. 1, 2 parts of No. 2, and 4 parts of No. 3, and thoroughly mix. The ordinary intensifier may be used. Either hyposulphite of soda or cyanide of potassium may be used for fixing.

EMULSION PROCESSES, Defects in. (1.) *Spots* may be attributed to dust from floor or shelves, fluff from the operator's coat, particles from the pouring bottle, dried emulsion from the neck of the pouring bottle, &c., &c. (2.) *Blisters* generally arise where a preservative of a gummy nature has been used. (3.) *Crape markings on the film*, from too much water in the emulsion. The alcohol and ether are of poor quality, perhaps. (4.) *Fog* may be the effect of the emulsion. Remedy for washed emulsion: the addition of a few drops of a dilute alcoholic solution of iodine; for crude or unwashed, nitric acid. (5.) *Fog* may also arise from light striking the plate during preparation or development. Search out the cause and remedy it. (6.) *Drying marks* in washed emulsions are generally caused by the plates being heated too much in drying. (7.) *Thin, transparent films*, perhaps the fault of the emulsion, or from its not having been shaken shortly before use. (8.) *The film peels off* when the pyroxyline gives a horny character to the emulsion. Mix with an emulsion made with a powdery sample. (9.) *Difficulty in pouring* evidences deficiency of solvents. Add alcohol, 1 part; and ether, 2 parts. (10.) *Insensitive spots*. A preservative should be used. (11.) *Damp spots* may sometimes be removed by washing the plate.

EMULSION PROCESSES, Light for Working. The light of the ordinary dark room is not favourable to the clean working of dry plates generally, and unless due precautions are taken, the operator is sure to be troubled with fog on his plates. The shadows occupy, so to speak, a superficial stratum of the film, while the lights and high lights penetrate, in greater or less degree, the body of the film, so that extraneous light is very likely to attack the shadows and spoil the image. Ruby glass—two thicknesses is safest—should be used when changing plates or developing. The camera, too, should be jealously examined at intervals to see that it is perfectly light-tight. *See* Camera.

ENAMELLING PHOTOGRAPHS. To impart a lustre to prints they are sometimes rubbed over with encaustic paste, *q.v.*, and burnished. Another process of enamelling is by coating the pictures with a film of gelatine and collodion. Polish a glass plate, and coat with a thin plain collodion, to which a few drops of castor oil have been added. Dry. To prepare the gelatine, cover with water and soak for several hours, and dissolve by placing the jar containing it in water over a brisk fire. Filter into a flat dish. The collodionized plates are slowly and steadily immersed, lifted slowly out, and put on a flat surface to dry. Two dishes of gelatine in a hot-water dish are placed handy. In one immerse several of the prints; place one of the plates, with the collodionized side upon the gelatine, in the other dish for a moment, and lift out; then place a print from the other dish in contact with the film. With a squeegee rub out the bubbles and excess of moisture, and set the plate on a rack to drain. Bristol board cut a little under the size of the print is softened in hot water, laid on the back of the print, pressed into perfect contact with the squeegee, and the plate placed on one side to dry by gentle heat. Trim round the print with a knife, and carefully

raise it from the glass. The enamelled picture is sometimes embossed and mounted on stout cards.

ENAMELS, also known as ceramic and burnt-in photographs, require no little skill and thought in production. A good negative, sharp, fully exposed, full of detail, clean, and bright, is required. From this a thin transparency, vigorous and full of detail, is produced, a thin and not too tough collodion being used. Develop with pyrogallic and citric acid. Tone with gold; but other toning solutions may be used. Wash thoroughly in water, and float the film on to the surface of the enamelled surface without crease. Trim, dry thoroughly, and, resting the plate on a sheet of iron, place it in the muffle. The process of burning-in can be watched. First the collodion film disappears, then the plate becomes red hot, and the image seems to disappear. At this point it should be removed from the muffle. Glaze, dry, and replace the enamel in the muffle until the glaze becomes liquid. Sometimes it is necessary to apply the glazing two or three times before the required surface is obtained. The dusting-in process is sometimes used for the production of enamels. *See* POWDER PROCESS.

ENCAUSTIC PASTE, for waxing prints, may be made by dissolving white wax by heat, and adding three-fourths the bulk of spirits of turpentine. Place the wax, in a china or glass bowl, in a vessel containing boiling water, and dissolve the wax. Gradually add the turpentine to the melted wax, stirring well all the while. Finally, add enough of essence, say cloves, to destroy the smell of the turpentine.

ENDOSMOSE, OR ENDOSMOSIS. (*Gr.*) Imbibition of fluids, gases, &c., through animal or vegetable membranes. It takes place from the more rare fluid to the denser. Opposed to *exosmosis*, which takes place from the denser to the rarer. In this way it is thought the blistering of collodion films and of albumenized paper may be accounted for.

ENGRAVING. *See* MECHANICAL PROCESSES.

ENGRAVINGS, TO COPY. *See* COPYING.

EPHEMERAL PHOTOGRAPHS. Mr. Woodbury, who introduces them, says:—These experiments, although of little value scientifically, are interesting, and add to the uses that the phosphorescent properties of the sulphides have been put to. Given the same strides that electricity has made, it is perhaps possible that in fifty years to come the study of phosphorescence may make equal advances, and photographs may be taken at night by the aid of the light that emanates from the walls of the studio. The process is simple, and has this advantage, that the same piece of sensitized paper may, owing to its ephemeral nature, be used over and over again, and at the same time always retain its sensibility. The material is the phosphorescent powder, sulphide of cadmium obtained by calcining oyster shells and treating with sulphur. A sheet of paper is coated with this by covering with gum or varnish, and dusting the powder over it. If this paper is exposed for a few seconds to light under a positive, and then removed to a dark room, a luminous positive will be seen, lasting a longer or shorter time, according to the exposure given. I have also produced phosphorescent portraits and views by the dusting-on process, substituting the powder for plumbago.

EPIPOLIC DISPERSION. *See* FLUORESCENCE.

EQUATION. Equivalence of two quantities differently expressed.

EQUIVALENT (*Lat.*) A term to express the particular weight or quantity of any substance which is required to saturate any other with which it can combine.

EQUIVALENT FOCUS. *See* FOCUS.

ESSENCE, in Chemistry, denotes the purest, most subtile, and balsamic part of a body, extracted either by simple expression, or by means of fire, from fruit, flowers, &c.

ESSENTIAL OILS. In Chemistry,

volatile oils having a strong aromatic smell, drawn from plants by distillation, in an alembic with water.

ESSENTIAL SALTS, such as are procured from plants, and have the property of crystallizing.

ESTHETICS (*Gr.*) The doctrine of taste; theory of the criticism of beauty in art.

ETCHING. Engraving on metal plates by means of acid. *See* MECHANICAL PROCESSES.

ETCHING (*Gr.*) backgrounds, &c., on the collodion film was practised by artists many years back, and many very artistic effects were by means of the needle produced. The practice, however, requires great skill and considerable knowledge of art, so that the process could never attain to any extent. It is, however, possible that by tracing engravings the process might be restored to its place of usefulness.

ETHER (*Gr.*, *Lat.*) $C_4H_{10}O$. An extremely volatile and combustible liquid, colourless, of fragrant odour and burning taste. Specific gravity 0·723, boils at 96° Fah. Formed in a variety of ways from ethyl compounds; or by heating a mixture of alcohol and sulphuric acid to 140°, when ether and water are given off. Ether mixes in any proportion with alcohol, and takes up one-ninth part of its bulk of water. Iodine and bromine are soluble in ether, the fixed volatile oils, and many of the resins, caoutchouc, the alkaloids, &c.,&c., more or less so. Chiefly used with alcohol as a solvent of pyroxyline for collodion. By adding a variety of acids to alcohol, and distilling from the mixture, varieties of ether are produced, as acetic, nitrous, sulphuric ether, &c.

EVAPORATION (*Lat.*) Going off, or causing to go off in vapours or fumes: process effecting the same.

EXOSMOSE, or EXOMOSIS (*Gr.*) The passage of fluids of different densities, gases, &c., through, from within, porous membranes. Opposed to Endosmose, *q.v.*

EXPAND (*Lat.*) To dilate, enlarge, spread out.

EXPOSURE. A term used in photography to denote the placing of a sensitive surface under the influence of light in the camera, or in the pressure-frame. In the exposure of the sensitive plate in the camera some considerable experience is necessary to judge of the proper time for impression to be made: and in a less degree for timing the photographic print, as its progress may be seen by opening the frame. In both cases the proper exposure is a matter of great importance. *See* OVER- and UNDER-EXPOSURE.

EXPOSURE OF THE PLATE, FAILURES IN. (*a.*) *Want of sharpness* is caused by faulty focussing; or movement of the sitter out of focus, before the exposure of the plate; or from the displacement of the ground glass. (*b.*) *Double outlines or "blurring,"* from movement of the sitter during exposure. (*c.*) *Harshness* of light and shadow is due to under-exposure, as (*d.*) *Flatness and lack of brilliancy* to over-exposure. (*e.*) *Dry insensitive edges to the plate* occur when it has stood too long. (*f.*) *Foggy spots* may be caused by reflection from the surface of the object, especially likely to occur in copying paintings. (*g.*) *Fog*, produced by light shining in the lens. (*h.*) *Double pictures* may be caused by a small hole in the camera front. (*i.*) *Unequal illumination* of double pictures may be from the unequal power of the two lenses, or from the inequality in thickness of the collodion film.

EXPOSURE OF THE PRINT, FAILURES IN. (1.) *Breakage of the negative*; generally carelessness, but sometimes due to warped frames, curvature of the glass, flaws, &c. (2.) *Small white spots*, caused by dust between the negative and paper; brush the glass before each exposure. (3.) *Blurred prints*, from unequal pressure. (4). *Double outline*, frame insecure, or careless handling in examining the print during exposure. (5.) *Unequal sharpness*. Inequality of the pad, or frame back out of place. (6.) *Unevenly printed shadows*, generally caused by printing a negative much retouched in the shadows in too strong

light. (7.) *Unequal exposure*, sometimes caused by shadow thrown by a projection of the house, &c., across the negative, paper blown upon the negative, &c. (8.) *Weak lights*, often caused by too frequent examination of prints in strong light. (9.) *Harsh vignetting*, from inexperienced cutting of the form; or from placing it too near the negative; too strong light in printing, &c. (10.) *Ill-shaped vignettes*, from badly cut forms, or light creeping in at one side. (11.) *Badly shaped medallions*, from cut-outs and masks badly cut or improperly used. (12.) *Ugly "fancy" printing* results from want of taste. Keep to plain printing. (13.) *Failure in greying vignette*. Want of skill and judgment, or too strong light. The background printed-in should never be darker than that of the negative. (14.) *Printed-in backgrounds* are extremely difficult, and it requires practice and taste to use them successfully. (15.) *Finger-marks* are to be avoided.

EXPRESSION. In Art, the distinct and natural exhibition of character or of sentiment in the persons represented. The portrayal of an object agreeably to its nature and character, and the use or office it is to have in the work. Not to be confounded with *passion*, which denotes a motion of the body, accompanied by certain indications of strong feeling shown in the countenance; so that every passion is an expression, but not every expression passion.

EXTERIORS, ACCESSORIES FOR. *See* ACCESSORIES.

EXTRANEOUS. Foreign; of different substance.

F. The chemical symbol of Fluorine.

FACE, IMPERFECTIONS OF THE. The so-called imperfections of the human face are those diviations from strict proportional balance which often produce different characteristics on each side, viewed in profile. As expressing a peculiarity of which notice must be taken in arranging the position of the sitter to secure a favourable likeness, the expression may perhaps be permitted. *See* FEATURES, INEQUALITY IN.

FADING (*Fr.*) The photographic print is extremely liable to fade, or become altered by time, even when preserved with the greatest care. It is extremely difficult to fix upon the cause of fading, though many theories affecting every manipulation of the process of printing have been advanced. By some it is thought that the instability of the photographic print is due to the substratum of albumen; and others attribute it to the liberation of free sulphur from the hyposulphite of soda in which the prints are fixed. Then, again, the toning bath is said to be at the bottom of the mischief; and many declare the washing of prints by the usual methods is insufficient to eliminate the sodium hyposulphite. By toning prints, after thorough washing, in an alkaline solution of gold chloride, using an alkaline fixing bath, and by careful washing, the hyposulphite may be removed. The mounting pastes are also supposed to cause fading, as, turning acid, they decompose the hyposulphite remaining in the print. Damp also causes fading. Mounting boards containing hyposulphite of soda may also cause fading. Sulphur may in every case be said to be at the root of the evil.

FAHRENHEIT THERMOMETER. *See* THERMOMETER.

FALSE DIFFUSION, and FALSE DISPERSION. *See* FLUORESCENCE.

FANCY BORDERS TO PRINTS are usually to be avoided as being the reverse of ornamental.

FAULTS OF MANIPULATION. *See* under distinctive headings of the several manipulations, in the Negative and Printing Processes, &c.

Fe. The chemical symbol of Iron (Ferrum).

FEATURES, INEQUALITY IN. The two sides of the face are often very dissimilar, so that in judging the best views to adopt for the photographic picture there are often contending considerations. The following hints will be found useful in guiding the artist in his

choice. The side generally selected is that which gives the best outline. Even in profiles the outlines of the two sides are very different. The nose is rarely perfectly straight, and some views of that feature are far better than others. This should generally be the first consideration. The mouth often has one corner lower than the other: choose the higher, as the expression on that side is brighter and better humoured. Irregularity in size, shape, and position of the eye is by no means uncommon: take the larger and higher, generally.

FEEBLE IMAGE. Insensitiveness of the film, from a new and unripe collodion, from over-acidity of the bath, temperature too high or too low, or a bath worn-out and impure. Sometimes the effect of over-development, either from its being unduly prolonged, or in the use of an over strong solution.

FERNS OR LEAVES, PRINTING FROM. By means of fern leaves, very pleasing designs may be produced. For the purpose, flat and transparent leaves are best, so that the light passes through the thin portions, and the delicate veins of the plant are indicated in the print. Press the leaves for a day or two in a book before using. First prepare a design for the intended composition. Now wax a piece of ordinary albumenized paper, and lay it over the design, which will serve as a guide in arranging the leaves. Glue one side of each leaf, and place in position on the waxed paper, and cover with blotting-paper, and rub down with the hand each leaf until the design is complete. Print as from a negative.

FERREOUS (*Lat.*) Made, consisting, or having the nature, of iron.

FERRIC (*Lat.*) Pertaining to or extracted from iron.

FERRO-CYANIDE OF POTASSIUM. *See* POTASSIUM FERRO-CYANIDE.

FERRO-GELATINE DEVELOPER. An iron developer to which gelatine has been added.

FERROTYPES. Positives on iron plates. *See* COLLODION POSITIVES.

FERROTYPE, TO COPY. *See* COPYING.

FERROUS SULPHATE. $FeSO_4 + 7H_2O$, Protosulphate of Iron. Sometimes known as copperas or green vitriol. This soluble salt is obtained by dissolving metallic iron, or ferrous sulphide, in sulphuric acid, or by the slow oxidation of pyrites. The solution yields, on evaporation, large green crystals of the salt. Like all the ferrous compounds, this salt easily takes up oxygen, producing a new salt called ferric-sulphate. Used extensively in photography as a developer, *q.v.*

FIBROUS (*Lat.*) Composed of, resembling, fibre.

FIELD OF A LENS. The luminous image as formed on the ground glass.

FIELD PHOTOGRAPHY. *See* LANDSCAPE.

FIGURE (*Fr. and Lat.*) Outline, shape, form. The representation of any animals, but more especially human beings, in a work of Art.

FILM (*A.S.*) Thin pellicle or skin; generally applied to the collodion coating of the plate.

FILM, COLOUR OF. *See* COLOUR OF THE FILM.

FILM, REMOVING USELESS. *See* GLASS PLATES, CLEANING.

FILM, SPLITTING OF. Generally caused by using dirty plates.

FILM STRIPPING. To remove a film from the glass for preservation, dry the negative and coat with a solution of india-rubber ten grains, in one ounce of benzole or chloroform; dry, and pour upon it castor oil five drops in one ounce of plain collodion; dry, and cut round the edges of the film, and place the negative in a dish of water. In a few minutes the film can be stripped from the glass. It is well to test the solutions on an old negative, for if the india-rubber solution be too weak the collodion may dissolve the film. Opalescence of the film can be removed by heat.

FILTRATION (*Lat.*) Process by which clear liquid is separated from any insoluble matter, by passing it through filtering paper, linen, cotton-wool, &c.

The last named makes an admirable filter. The wool should be moistened with alcohol or water, and thrown lightly into the bottom of the funnel. Bibulous paper is specially prepared for filtering photographic solutions. A little experience is required in folding the paper before placing it in the funnel, as it is liable to be broken and rendered useless. Fold the paper through the centre, again double, and yet again, and place in the funnel, so that it rests secure from slipping when the liquid is poured in. This should be done first on the side of the paper, for if a weight of liquid were poured at once on the centre of the paper it would break. Generally two papers are used together.

FIXING. A term generally used to denote the removal of the unaltered iodide and bromide from the negative; and the unaltered chloride from the print.

FIXING NEGATIVES. Hyposulphite of soda, 1 oz., dissolved in 8 ozs. of water; or cyanide of potassium, 1 oz., dissolved in 16 or 17 ozs. of water. A few grains of cyanide of potassium in the first bath have a beneficial effect on the colour of the film. The plate should be thoroughly washed before being placed in the fixing bath, and afterwards the fixing solution must be thoroughly removed by washing from the film.

FIXING NEGATIVES, FAILURES IN. (1.) *Bluish or greenish stain* on the film, from the developer not being washed off before the plate is placed in the fixing bath. (2.) *Greenish deposit* in the shadows shows imperfect fixation: strengthen the solution, or leave the plate a longer time in the bath. (3.) *Thin spots in the film* are caused by too active solution of cyanide of potassium. (4.) *Black streaks* arise from imperfect fixation. (5). *Splitting* of the film is attributable to imperfect washing after fixing. (6.) *Eating away of the film* where the cyanide is not washed off.

FIXING PRINTS. The conditions for proper fixation of prints is not always thoroughly understood by operators, and there is in consequence a great deal of guesswork in the operation. In dissolving the unaltered chloride of silver, the fixing solution of hyposulphite of soda converts it into hyposulphite of silver, which is soluble in an excess of hyposulphite of soda. If the bath is too weak, the hyposulphite of silver is not perfectly dissolved, and begins by degrees to decompose, by which a brown deposit is produced in the tissue of the paper. This deposit, known as measles or mealiness, showing in yellow patches and spots, is very evident when the print is held up to the light. Dissolve 1 ounce of hyposulphite of soda in 5 or 6 ounces of water, with a little liquor ammoniæ, a drachm to the pint of fixing solution, or a few grains of carbonate of soda. Some care is necessary in placing the prints in the fixing bath, as spots from the hyposulphite would stain the prints, and they must be evenly immersed. With the left hand lift the prints separately from the washing dish and drop each one on the surface of the fixing bath, then with the right hand instantly submerge it. The prints must be kept in motion and not allowed to stick together. Fix for ten or fifteen minutes, or until the whites appear perfectly clear, when the print is held up to the light.

FIXING PRINTS, FAILURES IN. (1.) *Stains and streaks* are formed on the print when it is not immersed in the fixing bath quickly and equally. (2.) *Spots, splashes, and finger-marks* are caused by handling the prints with fingers hypostained before the prints were placed in the bath. No trace of hypo must approach the prints, or a mark will be the consequence. If you cannot alone transfer the prints to the bath safely, you must get assistance. (3.) *Patches* are caused by the prints sticking together in the fixing bath. (4.) *Yellow spots*, sometimes appearing only when the prints are finished, are caused by air-bubbles which have prevented the even action of the bath. (5.) *Prints turn yellow* in an inactive bath: strengthen. (6.) *Cloudiness*—markings which afterwards turn yellow, caused by imperfect fixation. The

fault either of insufficient strength of the bath, or short time of immersion of prints.

FLARE. Stray particles of light falling on the sensitive plate during exposure. A fault in certain forms of lenses, so that when turned towards a strong light—as, for instance, the sky—a circular spot of flare is seen in the centre of the ground glass. The defect is probably due to reflection of the bright edges of the lens. If when a lens is directed towards the sky a ring round the circumference of the lens is observed, it may be known that with it a clear picture cannot be obtained of a view in which any portion of the sky is introduced.

FLATNESS. A want of vigour in the negative, caused in several ways: by the collodion deteriorating from age; insufficient pyroxyline, or poor sample; the bath too acid or worn out; the exposure over-timed, or faulty illumination of the object; the development, too strong solution, over-prolonged use, or from washing the free silver from the plate by pouring the developer too violently over the film, &c.

FLEXIBLE IVORY. *See* IVORY, FLEXIBLE.

FLINT GLASS. *See* GLASS.

FLOCCULENT (*Lat.*) Shreddy dregs.

FLOWERS, TO PHOTOGRAPH. Some skill and knowledge of the effect produced in photography by the different colours are necessary, and artistic taste in arrangement of the group. Gather as early in the morning as the buds are sufficiently open, and place in water. With some frail specimens, especially of wild flowers, there must be no unnecessary handling or delay.

FLUID. An appellation given to all bodies whose particles easily yield to the least partial pressure or force impressed; moving easily among themselves, and accommodating themselves to all changes of position, so as to always preserve a level surface. From the gravity of fluids arises their pressure, which is always proportioned to their gravity: for if the particles of fluids have equal magnitude and weight the gravity or pressure must be proportioned to the depth, and equal in any horizontal line of fluid.

FLUORESCENCE. A term used by Professor Stokes to denote a remarkable property possessed by certain substances with respect to light, and it has been adopted because fluor spar exhibits the phenomenon in a marked degree: otherwise it was termed *epipolic dispersion* and *internal dispersion*. By allowing a solar spectrum to fall on a fluorescent substance, such as a solution of sulphate of quinine, a peculiar blue diffused light makes its appearance on the surface of the fluid on which the actinic or ultra-violet rays fall. The light is found to possess less refrangibility than the incident rays, so that we witness the change of the refrangibility of the rays of light, the highly refrangible actinic rays being degraded into luminous rays of less refrangibility. The effect of fluorescence can be seen without having recourse to the spectrum. If daylight, or, still better, the highly actinic light of the flames of alcohol, or of sulphur burning in oxygen, are allowed to shine on a fluorescent substance, the phenomenon will be observed in a marked degree. The colour of the fluorescent light varies with different substances; thus, with a solution of sulphate of quinine, or aqueous infusion of horse chestnut bark, it is blue; with tincture of turmeric, or alcoholic extract of thorn-apple seeds, green; with uranium glass, greenish-blue; and with an alcoholic solution of chlorophyll, red. If sunlight is allowed to shine on a solution containing suspended particles, it is diffused in a manner which, at first sight, looks like fluoreseence, but this is simply due to the light illuminating the suspended particles. This is called *false diffusion* or *false dispersion*.

FLUORIDE OF POTASSIUM. *See* POTASSIUM FLUORIDE.

FLUORINE. F. 191. Occurs combined with calcium (forming calcium

fluoride), fluorspar, and cryolite. Many attempts have been made, but without success, to isolate fluorine.

FLUOR SPAR; calcium fluoride; sometimes used as a flux for the reduction of metals.

FLUX (*Lat.*) Substance used in the fusion of metals to produce reduction. *See* WASTE, REDUCTION OF.

FOCUS (*Lat.*) The same causes which produce chromatic aberration in a lens, tend also to separate the chemical from the visual focus. The violet and indigo rays are more strongly bent in than the yellow, and still more than the red; consequently the focus for each of these colours is at a different point. Lenses employed with the full aperture do not render near and distant objects sharp upon the ground glass of the camera at the same time. If the foreground is in focus the distance will not be sharp, and *vice versa*; but this is in some measure corrected by the use of the "diaphragm." The focal variation for near and distant objects is much more considerable when lenses of very long focus are employed, and (the distance from the object remaining the same) it is less evident with lenses of short focus. Hence lenses used for stereoscopic photography usually have some depth of focus with a comparatively large field. The "real" focus of a lens is a point through which an assembly of rays actually passes; a "visual" focus one through which their directions, if produced backwards or forwards, would pass. A lens is said to have "positive" focus when the focus of a parallel pencil refracted through it is on the same side of it as the origin of light; as in a concave lens. Here the focus is virtual. A lens is said to have a "negative" focus when the focus of a pencil refracted through it is on the side of it opposite the origin of light. A convex lens has negative focal length, and the focus is real. The principal focus of a lens is the focus of a pencil of parallel rays after refraction through it. The least circle of aberration is the nearest approach to a perfect focus which a direct pencil can have, and the circle of least confusion the nearest approach to focus possessed by an oblique pencil. It is incorrect to speak of the aberration of an oblique pencil. Geometrical focus, the focus of an infinitely small direct pencil, after reflection or refraction.

FOCUS OF A LENS, TO TEST THE. *See* ACTINIC FOCUS, TO FIND.

FOCUSSING, FAILURES IN. Generally from want of care in obtaining the focus; focussing too far forward or back; the ground glass not in place; shaking the camera out of position, &c., &c.

FOCUSSING GLASS. A magnifying glass for enlarging the image on the ground glass to enable the operator to obtain greater sharpness in the focus.

FOG. A veiling of the film by a deposit, either universal or partial, so as to obscure the image. Fog is most apparent in the deepest shadows, where there should be clear glass. The deposit is caused in several ways: dirty plates; the negative bath from alkalinity, and from its contamination by organic or foreign matter; bath dishes of gutta-percha may cause fog, as the gutta-percha is often impure; the collodion, if alkaline, will cause fog in an acid bath—add tincture of iodine to colour the collodion orange; the developer, too weak, when the deposit of silver is so slowly precipitated that the image appears to lose its attractive power and the silver is deposited over the entire plate, or too strong, so that the development cannot be arrested before the entire plate is veiled. The effects of weak or over-strong developer are repeated in cases of under and over-exposure. The omission of the acetic acid in the developer will cause fog. Diffused light in the dark-room, plate-holder, camera, through the lens, &c. Fog caused by the chemicals may be detected by the character of the deposit, as it is superficial and may be rubbed off by a tuft of cotton-wool or the finger; fog caused by light may not be thus removed.

FOG, TO REMOVE. A slightly fogged negative may sometimes be made fit for

printing by applying to the film a solution of iodine one grain, potassium iodide two grains, in one ounce of water, and dissolving the silver iodide with potassium cyanide, again apply the solution. Or by another method, one drachm of a saturated solution of ferric chloride in one ounce of water. Pour over the film, wash and clear with potassium cyanide. Dilute nitric acid, one part in ten of water, is sometimes efficacious.

FOG, TO TRACE THE CAUSE OF. If the deposit is on the surface, and may be removed by gentle rubbing, leaving the collodion film underneath undisturbed, the cause may be ascribed to the chemicals. First test the bath for alkalinity, and add a drop or two of dilute nitric acid. If a plate sensitized in it still fog, the fault may be in the collodion, or in the bath being contaminated with organic matter. Try another collodion, and the fault being still undiscovered, neutralize and boil the bath. *See* NEGATIVE BATH, TO RESTORE. If, as should be, there is another bath in working order ready for use, trial of it should be made, as the fault may be in the developer, or from vapours in the dark-room. If the fog be not removed by rubbing, test the dark-room by placing a sensitized plate for a minute or two in the position it is held in development, the door, of course, being closed as usual; the plate-holder, by taking a sensitized plate in it out into the light, and after a minute, developing; and the camera, by placing a sensitized plate in position, opening the slide, but not removing the cap of the lens. If the plate fog under any of these tests, remedy the defect; if still undiscovered, the fogging may have been caused by bad illumination of the sitter, or diffused light through the lens, as in the case of the sun shining directly on the lens or a strong reflection shining in. In these tests it is necessary to proceed carefully, and not attempt a rectification until the cause of fogging is surely found; especially with regard to treatment of the bath.

FORMULÆ (*Lat.*) In order to express shortly the composition of chemical compounds, a certain symbolic notation is used. Certain symbols are grouped together into what is termed a chemical formulæ, with the aid of which the chemical changes which occur when various bodies are put in contact can be conveniently represented by means of chemical equations. To represent the chemical composition of a substance letters are used to denote the elements which occur in it. These letters are, in general, the initials of the English or Latin names of the elements in question; thus H, hydrogen; K (kalium, *Lat.*), potassium; and two characteristic letters of the name when there are more than one with the same initial; thus, C stands for carbon, Cl for chlorine, and Co for cobalt; N denotes nitrogen, and Na (natrium, *Lat.*) sodium, (*see* VOCABULARY). In order to symbolise a body composed of several elements the letters denoting these elements are written one following the other, in an order depending on custom; thus, hydrochloric acid (hydrogen and chlorine) is written HCl, and potassic hydrate (potassium, hydrogen, and oxygen) KHO. But these initial letters are made to express more than this. According to the laws of chemical equivalence (*see* ATOMIC WEIGHT) the elements combine with each other in definite proportions. The symbols of the elements, therefore, represent their atomic weights, and when they unite in more proportions than one, they unite in quantities which are multiples of the weights known as their atomic weights; thus the combining proportion of hydrogen being the unit, H stands for 1, O for 15·96, K for 39·04; and when we write the symbol KHO for potassic hydrate it is understood that the body is composed of potassium, hydrogen, and oxygen, combined in the proportions 39·04, 1, and 15·96 by weight respectively. To represent combination in multiple proportions, we write suffixes in connection with the symbol of the elements concerned, as K_2O, denoting that $2 \times 39{\cdot}04$ parts by weight

of potassium are combined with 15·96 parts by weight of oxygen. A few words to explain the use of chemical equations. When we wish to represent a change taking place on the contact of two or more substances, we write on the left-hand side of the algebraic sign (=) equal to, the symbols of the bodies mixed, and put between them the sign (+) plus, and on the right-hand side of the sign of equality we write the symbols of the bodies produced by the reaction with the sign (+) between them. Thus $KHO + KCl = KCl + H_2O$. A large figure placed before a symbol multiplies every symbol and figure up to the next comma or + sign; *e.g.*, $3Cu\,N_2\,O_6$ expresses $Cu_3\,N_6\,O_{18}$. Again, the first formula may be written $3(Cu, 2NO_3)$; here a bracket is required on account of the comma, for without it the 3 would only multiply the Cu, and not the $2NO_3$. Halves or fractions of symbols are not allowed in construction of chemical formulæ; *e.g.*, $2(HO_{\frac{1}{2}})$ is not a correct symbol of water—it must be written H_2O. In representing a compound, the most electropositive element, *q.v.*, comes first, as water, H_2O, not OH_2, because H is the more electropositive of the two elements. The non-metals, with the exception of H, are electronegative; H and the metals are electropositive, consequently iron (Fe) with oxygen (O) would be written FeO, not OFe.

FRAMES, PRINTING. *See* PRINTING FRAMES.

FRAMING. The most suitable frames for photographs are those of oak, with an inner moulding of gilt. The print should be covered with a passe-partout, allowing a margin all round of about one-fifth the measurement of the length. Plain gilt frames also answer well. *See also* MOUNTING PRINTS.

FRONT LIGHT, EFFECT OF. Too strong front light thrown on the sitter causes a flattening of the face and the destruction of shadows. In the case of aged, wrinkled, or strongly lined persons, it may be used to advantage.

FULMINATE (*Lat.*) Explode with a crack and flash.

FULMINATES. Compounds of fulminic acid, or nitro-acetonitril, $CN.C(NO_2)H_2$, a body which has not yet been isolated. *Silver fulminate*, $CN.C(NO_2)Ag_2$, is formed by the action of alcohol on a solution of silver in nitric acid. It crystallizes in small white needles, which explode most violently on heating or on percussion. *Mercury fulminate*, $CN.C(NO_2)Hg$, is formed by dissolving mercury in nitric acid and adding alcohol. *Gold fulminate*, obtained by acting on a solution of gold with excess of ammonia. A yellowish-brown powder is precipitated, which, when dry, explodes very easily when heated to 100°, or when struck by a hammer.

FUMES (*Fr.* and *Lat.*) Care should be taken that stoppers of bottles fit perfectly, and that bottles are never left unstoppered, as fumes in a dark room often work mischief.

FUMING (*Fr.* and *Lat.*) Subjecting sensitized paper for printing to the fumes of ammonia. After sensitizing and drying, the sheets are placed in a box specially adapted to the purpose, and left ten or fifteen minutes under the influence of the fumes, rising from a saucer of ammonia placed in the bottom of the box. Fumed paper prints quicker, and gives richer and more brilliant prints. The toning of fumed paper is also more easily done, and the results more effective.

FUMING, FAILURES IN. *Insufficient fuming*, either from the weakness of the ammonia, or shortness of the time of fuming, causes weak, flat, red prints. *Over-fuming* produces blue, cold prints, sometimes with a metallic appearance. *Unequal fuming*, inequality in the prints.

FUNDAMENTAL COLOURS. From a mixture of red, green, and violet, all possible colours may be constructed, hence these spectral colours are called the fundamental colours.

FUSING THE BATH. *See* NEGATIVE BATH, TO RESTORE.

GALL (*A.S.*), OR BILE. An animal liquid contained in the gall bladder.

Specific gravity about 1·02. It is transparent and thick, of a green or brown colour, and of a peculiar odour. It contains resinous matter, colouring matter, fatty acids, and cholersterin, with mineral constituents. It combines readily with colouring matter and pigments, increasing brilliancy, and rendering them easy of working over paper, ivory, &c.

GALLERY (*Fr.*) *See* GLASS HOUSE.

GALLIC ACID. $C_7H_6O_5$. An organic acid contained in the most astringent parts of plants. Crystallises in long silky needles, slightly soluble in cold water, but very soluble in alcohol. When heated it decomposes into pyrogallic and carbonic acids. It is a weak acid, and forms salts with bases.

GALLON (*N. Fr.*) Liquid measure of four quarts.

GAMBOGE. Gum resin of the *Cambojia* stalagmites. A useful pigment frequently used for retouching portrait negatives and for stopping out skies of landscape negatives.

GAS LIGHT. *See* ARTIFICIAL LIGHT.

GELATIN. A pale yellow translucent substance, somewhat elastic and vitreous, obtained from bones, cartilage, and other animal substances. Isinglass is a very pure form of gelatin obtained from the sturgeon, while common glue is an impure kind obtained from refuse animal matter. Gelatin is insoluble in cold water, but swells and increases very much in weight after soaking in it, forming a jelly; this dissolves in hot water. A very dilute solution of gelatine has the property of gelatinising when cold; but prolonged boiling destroys this power. It is insoluble in absolute alcohol and ether, and in the fixed and essential oils; soluble in all dilute acids. Gelatine has many important uses in photography. Its composition has not yet been definitely ascertained.

GELATINE EMULSION. *See* EMULSION.

GELATINE, TEST OF PURITY. Place a little in a clean glass with distilled water, occasionally shake, and leave for some hours. The superposed water should not turn blue litmus paper red. It is then poured into a test-tube, and a few drops of a solution of chloride of barium or nitrate of lead mixed with it. If there is no deposit the gelatine may be used.

GELATINO-BROMIDE PROCESS. *See* EMULSION PROCESSES.

"GILDING DISSOLVENT." A liquid used for obliterating the images from Daguerreotype plates.

GLACIAL ACETIC ACID. *See* ACETIC ACID.

GLASS (*A.S.*) The chemical composition is that of mixed silicate of potassium or sodium with silicates of calcium, lead, aluminum, &c. The mixture must be so proportioned that there is not sufficient alkaline silicate present to render the product attackable by water or acids. Silicate of calcium increases the fusibility and also the resistance to the action of water. Silicate of aluminum renders glass less fusible and less liable to be acted on by water, whilst the more potash, lime, or oxide of lead increase, the more fusible and soft the glass becomes. Bottle glass has a specific gravity of 2·7; its composition is principally that of a mixed silicate of calcium and aluminum. Ordinary window glass is a mixed silicate of potassium and lead. Flint glass has a somewhat similar composition, but with varied proportions. There are two principal varieties of glass: the first comprises crown and plate glass; the second, flint glass. Crown and plate glass have a greenish colour; flint glass is colourless, and has a high refractive index. Glass is coloured red by gold or copper; blue, by cobalt; yellow, by silver or iron; green, by chromium; and opaque-white, by the addition of oxide of tin.

GLASS BATHS AND DISHES. For the negative bath an upright bath of glass is better than any other form or material. Glass dishes are unexceptionable, as they may readily be cleaned, and are not subject to surface fracture, as porcelain, &c. *See* BATH.

GLASS FOR LENSES. *See* LENS.

GLASS HOUSE. The chamber, having a skylight, in which photographic portraits, &c., are produced:

variously styled atelier, gallery, glass-house, glass-room, "light," skylight, studio, &c. Many forms of glass-houses have been from time to time proposed and built, but none offer so many advantages as the combination top and side light, and, what is the same in principle, the sloping side light. The side light should have a northern aspect, as in others the sun's rays more or less intrude at some time of the day. The glazed portion of the side, whether of the sloping side, or combination light, need not approach the ground nearer than four feet, and should not cover the entire side of the room. A space at either end, where the sitters are posed, should be boarded. Taking a room eighteen feet long by fourteen wide as an example, it would be found that ample illumination would be obtained from a sloping side light eight feet wide by eight feet high, commencing four feet from the floor, and running inwards to a point in the roof three feet from the perpendicular. This would give five feet at each end of boarded-up space for the sitter and the camera. The advantage of this is that either end of the "light" may be used to suit the requirements of artistic posing. Sufficient width of floor is necessary for working across the glass house to obtain "Rembrandt" effects. With the combination light, the glazed roof should be at sufficient angle to allow rain to run down readily, or leakage will result. The panes of glass used for the "light" should be as large as can conveniently be obtained, that there be a minimum of obstruction from sashes and overlappings.

GLASS PLATES FOR NEGATIVES. It is advisable to use a really good quality of glass; as flaws in common glass, and the breakage of thin and uneven pieces, more than balance the trifling saving in the original outlay.

GLASS PLATES, ALBUMENIZING. *See* ALBUMENIZING.

GLASS PLATES, COATING. *See* COLLODION, COATING THE PLATE WITH.

GLASS PLATES, CLEANING. The new plates should be first rinsed to free them from dust and straw of the packing then place in strong nitric acid solution, one by one, that the surfaces may be evenly wetted. After a few hours they may be removed and washed well under the tap, and, while still wet, albumenized, *q.v.*, when, on drying, they are ready for use. Old, used glass should be first placed in a dish of concentrated potash for twenty-four hours, the films removed by washing under the tap, and afterwards placed in the nitric acid for twenty-four hours. Wash and albumenize as already advised. Plates for negatives are sometimes polished by means of tripoli powder made into a paste with spirits of wine and a few drops of ammonia, or rouge; but the process is tedious, and, in comparison with that of washing and albumenizing, uncertain.

GLASS PLATES, FAILURES IN CLEANING. (1.) *Slipping of the film* under a jet of water evidences an insufficiently cleaned greasy plate (unless the unalbumenized side was used): return the plate to the potash solution. (2.) *Glossy precipitate* between the film and glass, another evidence of unclean surface, especially where the plate has before been used. (3.) *Transparent circular and straight marks* are sometimes caused by dampness. (4.) *Opaque streaks* may be from scratched glass. (5.) *Spots and short lines* under the collodion film are caused by dust and fibre falling on the plate before the albumen film has dried. (6.) *Dirty edges* are often due to dusty racks or shelves on which the albumenized plate is left to dry.

GLASS, SOLUBLE. *See* SOLUBLE GLASS.

GLOBE LENS. The style of a view lens introduced some years ago.

GLUCOSE. $C_6H_{12}O_6$. Dextrose, or right-handed glucose, grape, or starch-sugar, is found in many kinds of fruit, in manna, and honey, mixed with lævulose, or left-handed glucose. Used as a dry-plate preservative.

GLUE (*Fr. and Lat.*) An impure form of gelatine, *q.v.*

GLUE, LIQUID. An admirable cement for wood, glass, &c., may be

formed by dissolving one ounce, by weight, of powdered orange shellac in two fluid drachms of alcohol, sp. gr. ·805. The bottle should be placed in a warm place until the shellac is dissolved.

GLUTEN. (*Lat.*) Stiff, strong form of gelatine found both in the animal and vegetable kingdom.

GLUTINOUS (*Lat.*) Gluey, tenacious.

GLYCERIN (*Gr.*) $C_3H_5(OH)_3$. A colourless thick syrupy liquid, of sp. gr. 1·27. It possesses a sweet taste, hence its name; and is soluble in water and alcohol. It is a neutral substance, and exhibits no tendency to combine either with acids or bases. If spread upon glass or paper, it does not dry, but retains its moisture; and from this circumstance and its perfect neutrality it is employed as a means of preserving the moisture of sensitized films. When mixed with dilute nitric acid, glycerin undergoes oxidation and forms glyceric acid, $C_3H_6O_4$, by exchange of H_2 for O. If the nitric acid employed be concentrated, a new compound called trinitrin, or trinitroglycerin, is formed, a substance which explodes violently on percussion.

GOLD. (*A.S.*) Au=196·2. Always found in the metallic state; it occurs in veins in the older sedimentary or in the plutonic rocks; in traces in the sand of most rivers; and although found generally in small quantities, it is a widely diffused metal. Gold possesses a brilliant yellow colour, and, in thin films, transmits green light: it is nearly as soft as lead, can be drawn out into fine wire, and is the most malleable of all metals. Gold may be obtained pure by dissolving standard gold in *aqua regia* (one part by weight of nitric and two of hydrochloric acid), evaporating to dryness, re-dissolving the dry mass in distilled water, filtering, acidulating with hydrochloric acid, and then adding a solution of protosulphate of iron. A brown powder falls, which, after having been washed with dilute hydrochloric acid and distilled water, is pure gold. It may be fused in a crucible with a little borax, and a button of gold obtained. Protosulphate of iron is a very delicate test for the presence of gold, and it also throws down the whole of the gold from its solutions. No single acid has any action upon pure gold.

GOLD, FULMINATING. *See* FULMINATES.

GOLD RESIDUES. *See* RESIDUES, REDUCTION OF.

GOLD TRICHLORIDE. $AuCl_3$. Obtained when gold is dissolved in *aqua regia*. On evaporating the solution, crystals of a compound of gold trichloride and hydrochloric acid are deposited; gold trichloride also forms crystalline compounds with the alkaline chlorides. Gold salts can be easily recognised by the brown precipitate of metallic gold found on addition of the ferrous salts, which can be reduced to a globule before the blowpipe; and also by the formation of a purple colour (purple of cassius) when gold trichloride is added to a dilute solution of a mixture of the two tin chlorides.

GRAIN (*Lat.*) Smallest weight, of which twenty make a scruple, in Apothecaries' weight, and in Troy weight twenty-four make a pennyweight. *See* WEIGHTS AND MEASURES.

GRAMME. French weight, 15·432 grains. *See* METRIC SYSTEM.

GRAPE SUGAR. *See* GLUCOSE.

GREASE. Grease on the surface of the lens should be carefully removed by rubbing with soft rag and chamois leather. Paper is to be avoided, as liable to scratch the fine polish of the glass. A greasy glass plate should be rubbed clean with cotton wool or rag, and placed in the nitric acid or potash pots to remove the thin film of grease, then rinsed and coated with albumen. *See* ALBUMENIZING GLASS PLATES.

"GREASINESS" of the sensitized paper arises either from its being too dry when floated, or from insufficient sensitizing.

GREEN DEPOSIT on the negative shows imperfect fixation.

GREY SCUM on the paper is taken from the surface of a contaminated bath.

"GREY VIGNETTE." A vignetted print with the white margin surrounding the picture greyed or darkened to

the tone of the original background. *See* PRINTING.

GROUND GLASS. The focussing screen of the camera of ground glass. It is well to have marked on the screen pencil lines to correspond to the position of the plate in the holder, or, as in the case of a large camera in which several sizes are taken, a series of lines, and a cross through the centre, so that the figure is without difficulty placed in proper position on the screen and plate. The ground glass is placed in the camera ground side towards the lens. In case of accident, a substitute for the ground glass screen may be readily provided by coating a sheet of glass with a solution of starch, or with a varnish containing one per cent. of tartaric acid.

GROUP (*Fr.*) In the Fine Arts, an assemblage of figures or other objects.

GROUPING is the art of so combining and balancing the parts as to produce an harmonious effect. *See* POSING.

GUM (*Fr.*, *Lat.*, and *Gr.*) A name given to several substances of different composition, but of similar properties, exuding from stems and branches of trees. They are all more or less soluble in water, forming a thick, glutinous liquid.

GUM ARABIC. The natural exudation from several species of acacias; it consists chiefly of the potassium and calcium salts of arabic acid, $C_{12}H_{20}O_{10}$. Soluble in cold water, but more rapidly in hot; insoluble in alcohol, ether, and oils.

GUM DAMMAR. *See* DAMMAR.

GUM DRAGON. Gum tragacanth, *q.v.*

GUM GALLIC PROCESS. *See* DRY PLATE PROCESSES.

GUM GUAIACUM. A resinous exudation from the *Guaiacum officinale*, a lofty tree, native in Jamaica and St. Domingo. Soluble to the extent of ninety per cent. in absolute alcohol.

GUM SURFACE FOR RETOUCHING. *See* RETOUCHING.

GUM TRAGACANTH. The gum of *Astralagus Tragacanther*, a thorny shrub growing in Greece, Crete, and Asia. It is of a reddish-white colour, nearly opaque, and looks like twisted ribands. Dissolves in part in water, and forms a thick mucilage, which, when boiled with water, resembles a solution of gum-arabic.

GUN-COTTON. *See* PYROXYLINE.

GUTTA-PERCHA (*Malay*). A substance resembling india-rubber, and obtained like it from the juice of certain trees, principally from the *Isonandra Percha* and the *Isonandra Gutta*. It is of a light brown colour, specific gravity 0·98; insoluble in water, but softens by heat, solidifying on cooling to a hard, tenacious, leathery mass. Only a small portion of gutta-percha can be dissolved in absolute alcohol or ether, even with the aid of heat. Benzole and spirits of turpentine dissolve it partially when cold, and almost completely when hot.

GUTTA-PERCHA BATHS AND DISHES. *See* BATH.

H. The chemical symbol of Hydrogen.

HALATION. An appearance in the negative or print of a narrow luminous ring or halo surrounding a dark object, giving a hard outline and harshness of detail.

HALOID SALTS; HALOGENS. (*Gr.*) Haloid salts are formed by the combination of a salt radical, as bromine, chlorine, iodine, &c., with a metal, such as cadmium, sodium, potassium, &c. Cadmium bromide, sodium chloride, potassium iodide, are haloid salts. Bromine, chlorine, iodine, &c., are halogens.

"HARD" NEGATIVES, TO PRINT. *See* PRINTING.

HEAD REST. A machine used in photographic portraiture for maintaining the steadiness of the sitter during the time of exposure of the plate. In its simple form it was a rest for the head merely, two bowed prongs being fixed in a stand, and placed against the head to prevent motion; but improved rests provide support for the sitter's back. Great prejudice exists in the minds of sitters against the use of the rest; but this should be gently overborne by the artist. The rest should be placed lightly against the head, not the head to the

rest, care being taken not to disturb the pose, or bruise the sitter. Painful experience necessitates the last caution.

HEAT (*A.S.*) The principle in nature by the action of which fluids are evaporated, and solids are either dissipated in vapour, or rendered fluid, or vitrified.

HEAT, EFFECT OF, ON DEVELOPMENT, ETC. An increased activity of the developing solution is to be observed in hot weather, and it is necessary to increase the proportion of acetic acid to restrain this activity. In very hot weather the developer should be gently cooled—not frozen. Collodion bottles should be kept cool by means of damp rags, or ice. The bath-holder should also be cooled with ice. Remedy: ventilation, and artificial cooling of the dark-room, to keep all the chemicals at their normal temperatures.

HECTOGRAMME. One hundred grammes. *See* METRIC SYSTEM.

HECTOLITRE. One hundred litres. *See* METRIC SYSTEM.

HECTOMETRE. One hundred metres. *See* METRIC SYSTEM.

HELIOCHROMY (*Gr.*) One of the titles given to the art of photographing in natural colours. *See* NATURAL COLOURS, PHOTOGRAPHING IN.

HELIOGRAPHY (*Gr.*) Sometimes used as a style for photography, and for the photographic mechanical processes, *q.v.*

HELIOTYPE PROCESS. *See* MECHANICAL PROCESSES.

HEMATIN, or HEMATINE. The colouring principle of log-wood, of a pale red colour and bitter taste.

HEPAR SULPHURIS, or LIVER OF SULPHUR. The name sometimes given to a sulphuret made either with potassium or soda.

HERMETICALLY; from *Hermes* (*Trismegistus*) the name of a reputed Egyptian philosopher. Having the character of chemistry, alchemy, or magic. The special application of the term being to the corking, sealing, or closing of vessels, so as to make them air-tight.

"HESITATION LINE." A horizontal line on the negative, caused by the stoppage of the collodionized plate in its immersion in the sensitizing bath. *See* IMMERSION OF PLATE.

HETEROGENEOUS (*Gr.*) Opposite, or dissimilar in nature.

Hg. The chemical symbol of mercury (Hydrargyrum).

HIGH LIGHTS. Bright specks of light reflected from prominent parts of the figure. *See* LIGHTING.

HOMOGENEOUS (*Gr.*) Having identity, similarity, or uniformity of nature.

HOMOGENEOUS LIGHT. The light emitted from luminous bodies is seldom o never pure. On being examined by the prism it will be found to contain more than one colour. In optical researches it is frequently of great importance to procure homogeneous or monochromatic light. Common salt in the flame of a Bunsen's lamp gives a yellow of great purity. For red light, ordinary light is transmitted through glass coloured with suboxide of copper, which absorbs nearly all rays except the red. A very pure blue is obtained by transmitting ordinary light through a glass trough containing an ammoniacal solution of sulphate of copper.

HONEY (*A.S.*) A sweet liquid secreted by bees; sometimes used for preserving the moisture of a sensitized film under a long exposure.

HORN SILVER. The name by which silver chloride is known when it occurs in nature.

HORSES, PHOTOGRAPHING. *See* ANIMALS.

HYDRATES. In Chemistry, a solid which contains water in a fixed state, as slaked lime, soda, &c.

HYDRIDES. Compounds of hydrogen with another element.

HYDRIODATES. Salts formed by the combination of hydriodic acid with basis.

HYDRIODIC ACID, OR HYDROGEN IODIDE. H.I. Iodine and hydrogen may be made to unite with each other by heating them together; hydriodic acid is liberated when dilute sulphuric

acts on an iodide. It is a colourless gas, possessing a strong acid reaction, and fuming strongly in the air. Very soluble in water, yielding a solution which boils at 127°.

HYDROBROMIC ACID. HBr. A gaseous compound of bromine and hydrogen, composed of equal volumes of bromine vapour and hydrogen.

HYDROCARBONS. Combinations of hydrogen and carbon; forming a very important and numerous class of organic bodies. The majority of hydrocarbons are gaseous. The most plentiful source of hydrocarbons is the destructive distillation of wood, coal, &c.

HYDROCHLORATE OF AMMONIUM. *See* AMMONIUM CHLORIDE.

HYDROCHLORIC ACID. HCl. A gaseous compound of hydrogen and chlorine, formed by mixing the gases in equal volumes. They do not unite in total darkness, but a lighted match, or exposure to the sun's rays, causes them to explode, whilst diffused daylight, or artificial light, induces their slow union. They unite without contraction or expansion. Hydrochloric acid is usually prepared by decomposing sodium chloride by strong sulphuric acid. In a dry state it is a colourless, strongly acid gas, having a pungent odour. Water dissolves 458 times its volume of the gas, forming the ordinary hydrochloric acid of commerce. Sometimes called muriatic acid. Mixed with nitric acid it forms nitro-hydrochloric acid, *aqua regia*.

HYDROCYANIC ACID, OR PRUSSIC ACID. HCN. Has recently been obtained by the direct union (without condensation) of nitrogen acetylene, when a series of electric sparks is passed through a mixture of these gases: $N_2 + C_2H_2 = 2$ HCN. This acid easily undergoes decomposition, and cannot, therefore, be kept for a length of time, either in the pure state, or in aqueous solution. It is highly poisonous: the most effective antidotes are ammonia and chlorine. Added to a silver nitrate solution, it throws down insoluble cyanide of silver.

HYDROFLUORIC ACID, OR HYDROGEN FLUORIDE. HF. Sulphuric acid and calcium fluoride give hydrofluoric acid and calcium sulphate. Hydrofluoric acid gas must be prepared in a leaden or platinum vessel, as glass is rapidly attacked by the vapour. The colourless gas thus obtained fumes strongly in the air; if it be passed into a metallic tube placed in a freezing mixture at the temperature of 20°, a liquid is formed; this liquid is strong aqueous hydrofluoric acid. It appears doubtful whether the dry acid HF has been obtained in the liquid state. When brought into contact with water, the strong acid dissolves with a hissing noise. This aqueous acid attains a constant boiling point under the ordinary atmospheric pressure, when the liquid contains thirty-seven per cent. of HF. The most remarkable property of hydrofluoric acid is its power of etching upon glass. (*See* MECHANICAL PROCESSES). This arises from the fact that fluorine forms, with the silicon in the glass, a volatile compound called silicon tetrafluoride. The fumes of hydrofluoric acid destroy the polish and dim the surface of glass, and in this way focussing screens may be made instead of by grinding the glass.

HYDROGEN. H=1. A colourless, invisible gas, possessing neither taste nor smell. It is the lightest body known, being 14·47 times lighter than air; and is therefore taken as the unit in the scale of equivalence. It occurs free in small proportions in certain volcanic gases, and it has been lately shown to exist absorbed in certain specimens of meteoric iron; but it is found in much larger quantities, combined with oxygen, to form water, and it is by the decomposition of water, or some other similar hydrogen compound, that the gas is always prepared. The metals of the alkalies, potassium and sodium, decompose water at ordinary temperature of the air; some other metals, as iron, are only able to do so at a red heat; whilst others—for instance, gold and silver—are unable to decompose water at all. When a small piece of potassium is thrown into water, an instantaneous decomposition of the

water ensues, potassium hydro-oxide (caustic potash) is formed, and the hydrogen of the water is liberated, so much heat being evolved at the same time that the hydrogen takes fire and burns. If potassium—or, still better, sodium—be wrapped in a piece of wire gauze and held in the water of the pneumatic trough, under the mouth of a cylinder, the hydrogen gas may be collected. It may also be prepared by passing a jet of steam through a wrought iron pipe, like a gun barrel, filled with iron turnings, and heated in a furnace to a red heat. Hydrogen is inflammable, but extinguishes flame. When mixed with oxygen or atmospheric air in sufficient quantity it explodes with violence. Hydrogen plays an important part in many of the chemical changes produced by light.

HYDROGEN CHLORIDE. *See* HYDROCHLORIC ACID.

HYDROGEN FLUORIDE. *See* HYDROFLUORIC ACID.

HYDROGEN IODIDE. *See* HYDRIODIC ACID.

HYDROGEN SULPHIDE, OR SULPHURETTED HYDROGEN. H_2S. Formed when hydrogen is led through boiling sulphur, but is better prepared by the action of dilute sulphuric acid upon iron sulphide, FeS, iron sulphate, being also formed. Sulphuretted hydrogen gas dissolves in water to a considerable extent, inparting its peculiar, offensive smell and a slightly acid reaction to the water. One volume of water at 0° dissolves 4·37 volumes of the gas, while at 15°, 3·23 volumes are soluble. Exposed to a temperature of —62°, this gas condenses to a colourless, mobile liquid, which, when further cooled to —85° freezes to a transparent ice-like solid. Upon a pressure of seventeen atmospheres it liquefies at the ordinary temperature of the air. Sulphuretted hydrogen is an invaluable reagent in the laboratory, as by its means we are enabled to separate the metals into groups.

HYDROMETER. (*Gr.*) An instrument for determining the specific gravities of liquids. Its commonest form is a long graduated tube attached to two bulbs, the lower being weighted with quicksilver. The principle of the instrument is that a floating body displaces a quantity of liquid exactly equal in weight to itself. The hydrometer affords a measure of the volume of the liquid necessary to counterbalance in weight the weight of the instrument. For solutions of silver, &c., the commoner forms roughly indicate the number of grains per ounce in solution by the part of the scale corresponding to the surface of the liquid. It is well, as they are not prepared with any great care, to test their accuracy on a solution of silver nitrate in distilled water, to see if the known strength of the solution corresponds with that marked. The indications of the hydrometer are not to be trusted when the solution is charged with alcohol and ether, or organic matter; hence an old negative bath may be found to yield some grains over the quantity indicated by the hydrometer. It is, however, a sufficiently good test for most practical purposes. The instrument should be carefully kept. The glass tube in which the liquid to be tested is taken, should, with the hydrometer, be kept clean and free from dust and substances likely to contaminate the silver solution.

HYPO BATH. *See* FIXING OF NEGATIVES AND PRINTS.

HYPOSULPHITE OF SODA. *See* SODIUM THIOSULPHATE.

HYPOSULPHITE OF SODA AND GOLD, DOUBLE, known as Sel d' Or, is formed in the simple toning and fixing bath at one time in use, where a solution of gold chloride is added to sodium hyposulphite. The single toning and fixing bath is, however, complex and inconstant, from the decomposition of the sodium hyposulphite in presence of gold chloride.

I. The chemical symbol of Iodine.

ICE (*A.S.*) Water or other fluid congealed, or in a solid state. When water is exposed to a temperature below 32° Fah., it assumes a solid state by shooting into crystals, which cross each

other in angles of 60°. It is lighter than water, so that its bulk is greater than that of the water of which it is formed. This increase of magnitude is acquired with prodigious force, sufficient to break the strongest vessel. Water in freezing rejects impurities; melted ice is, therefore, useful in making bath solutions, &c.

ICELAND MOSS (*Cetearia Islandica*). A species of lichen found in Iceland and the mountainous parts of Europe. Boiled in water it swells, and gelatinizes on cooling.

ICELAND-SPAR, OR CALCSPAR. A form of lime carbonate which is found in beautifully crystallized masses. It possesses in a very high degree the property of double refraction.

ICHTHYOCOLLA. Isinglass, *q.v.*

IGNITION (*Lat.*) The state of becoming luminous by the application of heat. When this effect is attended by oxidation, the term *combustion* is used. The term *spontaneous* is generally prefixed when the ignition is a consequence of slow and gradual accumulation of heat from oxidation.

ILLUMINATION. A term used to express the direction of the light upon an object before the lens for the purpose of obtaining its representation upon the sensitized plate. *See* LIGHTING.

IMAGE (*Fr.* and *Lat.*) in Optics, is the appearance of an object made either by reflection or by refraction.

IMAGE, IMPERFECTIONS OF THE PHOTOGRAPHED. *See* under head of the several manipulations.

IMAGE, LATENT. The action of light on the sensitive plate is a question which has long engaged the attention of photographers, and several theories have been advanced. By some it is said to be molecular, or such a disarrangement of the particles of the film as to render it susceptible to the influence of the developer, so that silver is deposited on those parts affected by this molecular change. Others affect the theory that a chemical action has been started which the development continues and completes. The scope of this book will not, however, permit of the reproduction of the interesting arguments adduced on the one side and the other.

IMBIBITION (*Lat.*) Act of sucking, or drinking in.

IMMERSE. (*Lat.*) Put under, or as under, water.

IMMERSION of the collodionized plate into the sensitizing bath requires considerable care, or failure will result. The collodion film having "set"—*i.e.*, assumed that condition when, being touched by the tip of a finger, it takes the impression as would soft wax, without tearing—it is placed on the dipper and lowered steadily into the bath. The descent should be slow, steady, and so as not to cause splashes. The plate should be placed on the dipper thin edge downwards, so that the thicker upper edge is allowed a trifle extra time for drying, and for the reason that the thinner edge does not resist the action of the solution. When the plate is fully covered by the solution, it may be gently agitated with a gentle circular motion of the hand, to overcome the repulsion between film and bath solution.

IMMERSION, FAILURES IN. (1.) *Horizontal lines*, technically known as "hesitation marks," show that the dipping of the plate has been arrested, the surface of the solution at the instant of stoppage marking a line, which appears, on development, across the the plate. (2). *Perpendicular lines* are sometimes caused by too rapid an immersion of the plate; or from the plate being withdrawn before it is fully sensitized. (3). *Splashes* on the plate from too sudden immersion leave their mark on the film, and form serious blemishes. (4). *Black streaks*, springing from the points of the dipper, often arise from dirt or scum caught there. *See also* SENSITISING THE PLATE, FAILURES IN.

IMPACT (*Lat.*) Collision, with special reference to its results as a moving power.

IMPERIAL MEASURE. *See* WEIGHTS AND MEASURES.

IMPERIAL PICTURE. The style of a photographic picture.

IMPERFECTIONS IN THE MANIPULATIONS. *See* under special heading of each manipulation, or process.

IMPERFECTIONS OF THE FACE. *See* FACE.

IMPERMEABLE (*Lat.*) That may not be passed through.

IMPONDERABLE (*Lat.*) Incapable of being weighed—wanting weight (actually or approximately). Applied in Physics to light, heat, and the electric force, when considered as substances.

INCIDENCE, ANGLE OF. The angle which a ray of light falling on a surface forms with the perpendicular of that surface, or to its tangent if curved. The angle of incidence and the angle of reflection are always equal.

INCORRODIBLE INK for writing labels of bottles containing strong acids or alkalies:—Dissolve one part of asphaltum in two parts of oil of turpentine.

INDIAN INK. A substance manufactured in China; used in photography in retouching negatives, touching up prints, &c., and for artistic finishing of prints.

INDIA-RUBBER. *See* CAOUTCHOUC.

INDIGO (*Lat.*) $C_{16}H_{10}N_2O_2$. A valuable dye and pigment, the blue colouring matter derived from several species of *Indigofera*. The leaves are macerated in water, when they undergo oxidation, forming a yellow solution, which, on exposure to air, deposits indigo in the form of a dark blue powder. It is insoluble in water and in alcohol and ether; strong or fuming sulphuric acid dissolves indigo, forming a deep blue solution. When indigo is exposed in contact with alkalies to reducing agents it passes into a soluble and colourless substance by absorption of hydrogen. This is known as white indigo, its formula being $C_{16}H_{12}N_2O_2$.

INEQUALITIES IN FEATURES. *See* FEATURES.

INFLECTION, OR INFLEXION (*Lat.*) In Optics, the bending or refraction of rays of light; caused by the unequal thickness of any medium.

INFUSION (*Lat.*) A method of extracting the virtues of plants, roots, &c., by steeping them in a liquid. Also the liquor in which the plants have been steeped, which is impregnated with their qualities or virtues.

INK PROCESS. An interesting process by which prints may be obtained in common writing ink. Immerse the paper in a nearly saturated solution of potassium bichromate. Dry in the dark. It is of a bright yellow colour. Expose in a printing frame under a negative until all detail is out, the image appearing a pale brown on the yellow ground. Wash in several changes of water for two or three hours. The print is now permanently fixed. To give colour, immerse in a 5-grain solution of ferrous sulphate in water for a few minutes, and wash as before for two or three hours. When thoroughly washed, immerse in a moderately strong solution of tannic acid, and tannate of iron or writing ink being deposited, a black image is formed. Wash well and dry. The difficulties of the process consist in perfectly eliminating the chromium and ferrous salts, and in obtaining blacks of sufficient depth and vigour.

INSENSITIVENESS. Condition of plate and paper when, by reason of impure chemicals or improper treatment in the manipulations, the image will not form under the action of light, or appears but slowly. The fault is generally attributable to contamination of the sensitizing bath.

INSOLATION. Exposure to the sun.

INSPISSATE (*Lat.*) Thicken; make thick.

INSTANTANEOUS PHOTOGRAPHY. Pictures obtained in a fractional part of a second are termed instantaneous. Perhaps the most notable example of rapid exposures of a sensitized plate was the photographing of the gallop of a horse.

INSTANTANEOUS SHUTTER. *See* DROP SHUTTER.

INTENSE NEGATIVES, TO PRINT. *See* PRINTING.

INTENSIFICATION. A continuation of the action of the developer on the

exposed plate. Generally this is effected by increasing the deposit of silver on the image already formed. Pyrogallic acid and silver, and the ordinary developer to which a little silver solution has been added, are used. For the first, mix four grains of pyrogallic acid and four grains of citric acid in three ounces of water. Pour over the plate sufficient of this solution to thoroughly wet the film; return the solution to the pouring cup, and add a few drops of an aqueous solution of silver nitrate; mix, and again pour over the plate. Continue the action until the desired intensity is gained, or the solution grows muddy. With the ordinary iron developer add a few drops of silver solution and alcohol, and, having wetted the film with water, pour the iron and silver over it. Another method is sometimes adopted: that of darkening or rendering the colour of the film already formed on the plate non-actinic, as by the action of potassium sulphuret. Take a small lump of the sulphuret in a developing cup containing water, and, before dissolution is complete, pour the solution on and off the plate; the solution gaining strength each time. Before proceeding to intensification, the plate should be washed free of the developer.

INTENSIFICATION, FAILURES IN. (1) *Stains* are caused by unequal action of the intensifying agent. (2) *Crawling marks* are consequent on flowing the pyrogallic and silver solution over a plate which has not previously been wetted with plain pyrogallic solution. This precaution must never be omitted. (3) *Spots*, when using the iron intensifier, are caused by insufficiency of alcohol; also by excess. (4) *A grey deposit* is sometimes formed on the plate with the iron and silver where the action has been too long continued. (5) *Bluish precipitate in the shadows* is caused by want of acid in the intensifier, or from age of the solution. (6) *A circular stain* occurs where the intensifier has been repeatedly poured on the plate at one spot.

INTERFERENCE OF LIGHT. The name interference is given to the mutual action which two luminous rays exert upon each other when they are emitted from two neighbouring sources, and meet each other under a very small angle. If two similar rays start from the same place, at the same time, they increase each other's intensity, and the result is a wave of double light; but if one wave is half an undulation in advance of the other, the crest of one occupies the position of the hollow of another, and the result is a dead level. If the intervals of starting are less than half a wave's length, the result is a series of smaller waves, the magnitude of which depends upon the distance which one wave has in advance of the other. The interference of the waves of light may be produced in many ways; by diffraction, or by reflection from thin plates, such as soap bubbles; from grooved surfaces; or from minute particles, such as atmospheric mist.

INTERIORS. The photographing of interiors of buildings requires considerable skill and experience. More than a few general hints are not possible in this place, as the conditions vary so widely under different circumstances. Rapid dry plates are of great service in taking these views, but if wet plates are used it is necessary that the bath in which they are prepared should be new and pure. The addition of about one drachm of pure glycerine to each twenty ounces of bath solution adds to the power of keeping the plate moist under long exposure. Several thicknesses of blotting-paper, soaked in cold water, placed at the back of the plate also helps to keep it moist. Careful selection of the spot for the camera best adapted to secure the required view should be made beforehand; and if several views of a large building are to be made, these positions should be fixed upon, and marked, the day before taking the views. At the same time the effects of the light at different periods of the day should be carefully noted, to secure the best effect of chiaroscuro. As an aid to focussing it is a good plan to mask the portion of the

ground glass on the edges outside the size of the picture, the image being clearer and sharper when the extraneous portion is shut out. Take care to level the camera, that the perpendicular lines are true. A thirty-grain silver nitrate bath, faintly acidified with nitric acid, will be found to give good results. Develop with the ordinary strong iron solution: ferrous sulphate, 1 ounce; glacial acetic acid, 1 ounce; alcohol, 1 ounce; in ten ounces of water.

INTERIORS, ACCESSORIES FOR. *See* ACCESSORIES.

INTRINSIC LIGHT is in contradistinction to borrowed light. Thus the sun, a candle, &c., shine by intrinsic light; but the moon, and most natural objects, shine by borrowed or reflected light.

IN VACUO (*Lat.*) In empty space, or space comparatively empty.

INVISIBLE IMAGE. *See* IMAGE, LATENT.

INVISIBLE RAYS OF THE SPECTRUM. *See* SPECTRUM.

IODIDE. A substance formed by the union of iodine with a metal.

IODIDE OF CADMIUM, ETC. *See* CADMIUM, ETC., IODIDE.

IODIDES, BROMIDES, ETC., IN COLLODION, DEFECTS DUE TO. (1). *Opaque markings in the Sensitized film*, at the corner whence the collodion was poured off, is sometimes attributable to the presence of too much iodide and bromide in the collodion. Add plain collodion. (2). *Crapy markings* in the film arise from the use of gelatinous collodion, or from the presence of water in the collodion. (2). *Weak image*, with opalescence of the film, is often due to a deficiency of pyroxyline in the collodion. (4). *Lack of half-tone* may be attributable to the pyroxyline having been prepared at too high a temperature, or to the iodine being liberated in excess, the latter being shown by the red colour of the collodion. (5). *Too dense an image and no detail*, where iodides are in excess. (6). *Weakness with plenty of detail*, where bromides are in excess, or alone used. (7). *Splitting of the film*—Probably from an excess of ether; or from the pyroxyline made with too strong acids. (8). *Flatness of the image*—Sometimes caused by under-iodized collodion. *Some of these defects* may be attributable to defects in coating the plate, or sensitizing. See defects in these operations.

IODIDES USED IN COLLODION. Iodides produce density of the image at the expense of detail, and quickness of working. The iodides employed in photography are ammonium (9·40), cadmium (6·92), potassium (7·64), zinc (7·95). The figures represent the combining proportion of iodine.

IODINE. I. 126·53. Iodine occurs combined with metals in sea-water, and is obtained from kelp, the ash of certain seaweeds, in which it is found as the iodides of sodium and magnesium. Iodine is obtained from kelp by exactly the same process as that by which chlorine and bromine are obtained from chlorides and bromides; viz., by heating with sulphuric acid and manganese dioxide; iodine is thus liberated in the form of a violet-coloured vapour, which condenses to a dark grey solid, with bright metallic lustre. Iodine melts at 115°, boils above 200°, and has a specific gravity of 4·95. It gives off a perceptible amount of vapour at the ordinary temperature, and possesses a faint, chlorine-like smell. Water dissolves a very small quantity; but in presence of a soluble iodide it is freely dissolved, forming a deep red or brown solution. It is easily soluble in alcohol, giving a reddish-brown solution.

IODIZER; IODIZING. *See* COLLODION, and NEGATIVE BATH.

IODIZING THE BATH. *See* NEGATIVE BATH.

IRIDESCENCE (*Gr*). Exhibition of prismatic colours. This term is generally applied to the phenomena of interference colours, shown by grooved surfaces or thin films; thus we speak of the iridescence of mother-of-pearl and of a soap bubble.

IRON, PROTOSULPHATE OF. *See* FERROUS SULPHATE.

ISINGLASS (*German*). A substance consisting chiefly of gelatine, which is obtained from the sounds or air-bladders of those fish from which this membrane may be separated with sufficient ease. The sounds of fresh water fish are to be preferred, because of their greater transparency, flexibility, and delicacy; but those of the cod and ling are collected and prepared. The coarser kinds of isinglass are made of the intestines of the fish. The preparation of isinglass from salt water fish is merely that of freeing the sound from the membranes out of its side, putting it for a few minutes in lime water that its oily principle may be absorbed, and washing it in clean water. It is soluble in boiling water, and gelatinizes on cooling. *See* GELATIN.

ISOMERIC (*Gr.*) Compounds which contain the same elements in the same ratio, yet exhibit distinct chemical qualities, are said to be isomeric.

ISOMORPHISM (*Gr.*) There are various elements which may take the place of each other in crystalline form, or at most with only a slight alteration of its dimensions. Such a group of elements we have in the earths, lime and magnesia, the protoxides of iron and manganese, for the carbonates of all these bases occur crystallized in the forms of the hombohedral system, the characteristic angle being nearly the same in all. Now lime and magnesia, by the discoveries of modern chemistry, are really oxides of metals; and therefore all these carbonates have a similar chemical constitution, while they have also a similar crystallized form.

"IVOIRE DUR." A photographic print on porcelain, or fine earthenware, to imitate the effect of an ivory picture. Mr. Window, who introduced the picture, recommends printing by the carbon process as being easier and giving better results; but it may also be produced by the ordinary silver process. The plate is albumenized, coated with collodion, sensitized, and printed in the camera from an ordinary negative either as a reproduction or enlargement. If the plate does not fit the dark slide, it is affixed to a glass plate, allowance being made for the difference in the position of the surface of the plate and that of the ground glass. The plate is then developed and fixed, and afterwards toned. Varnished: a spirit varnish should not be used, nor should heat be applied. The picture is now coloured.

IVORY. (*Fr.* and *Lat.*) The tusks and teeth of the elephant and walrus, &c.; a hard, solid substance, of a fine white, creamy colour, and greatly esteemed for the fineness of its grain, and the high polish it is capable of receiving. Ivory is liable to turn yellow by time, but its whiteness may be restored by rubbing it with pumice stone, and exposing it in a moist state to sunshine. Photographs are sometimes made on ivory plates. Collodion positives on ivory stained violet, or black. To obtain the violet stain, boil the ivory for a short time in tin proto-chloride, and afterwards in logwood; for the black, boil first in a decoction of logwood, and then in a solution of red iron acetate. The plates are afterwards polished.

IVORY, ARTIFICIAL, has been made and used for the purposes of photography; by rolling into sheets a mixture of sulphate of baryta and albumen;—by a mixture of ivory dust with albumen, rolling the paste into sheets and drying and polishing;—by the immersion of a sheet of gelatine in alumina dissolved in acetic acid;—and, gelatine with white papier maché rolled into sheets.

IVORY BLACK. Ivory dust calcined in a close crucible.

IVORY, FLEXIBLE. Ivory may be rendered flexible and semi-transparent by immersing it in pure sulphuric acid until it loses its opacity. Washed with water it becomes flexible, but hardens on exposure to dry air. Immersion in hot water again makes it flexible.

IVORY, VEGETABLE. A substance like the true ivory, supplied from the seeds of the *Attalea funifera*, and *Phytelephas macrocarpa*.

JAPAN. Having the character of a certain kind of Japnaese work, the chief characteristic of which was its rich black varnish. Applied to coatings of paper, leather, etc., for collodion positives, and to the iron plate used for the ferrotype. *See* COLLODION POSITIVES.

JAPAN VARNISH. A serviceable black varnish may be made by mixing chloroform, 4 ounces; asphaltum, 4 ounces; and Canada balsam, 1 ounce; or, shellac 1 drachm; oil of turpentine, 2 ounces; alcohol, 4 ounces; and lamp-black, half an ounce.

JEWS PITCH. *See* ASPHALT.

JUICES OF PLANTS. It has been observed that the juices of various plants are altered in colour by exposure to light. The pulp produced by crushing the petals of the flower in a mortar, spread over a sheet of paper, and dried in the dark, will bleach under exposure in the portions touched by light. The result of Sir John Herschel's experiments, communicated to the Royal Society, showed that the most sensitive colour was the yellow tint of the *Corchosus Japonica*, which speedily changed under the influence of light. The blue tincture of the double purple groundsel is also completely bleached by sunshine.

K. The chemical symbol of Potassium (Kalium).

KALI. *Salsola Kali*, or glass-wort, a genus of marine plants, from which the alkali of commerce is procured by burning.

KAOLIN, (*Chinese*), OR PORCELAIN CLAY, is the purest form of disintegrated felspar, containing no iron or other impurities. Useful in photography for decolorizing sensitizing solutions. For this purpose a small quantity is placed in the bottle containing the discoloured solution, and shaken well. When the kaolin has settled in the bottom of the vessel the clear liquid is decanted and filtered. The kaolin may be used several times.

KELP, the calcined ashes of a marine plant, sometimes known by the same name, but otherwise by the denominations of sea-thongs, laces, and glass-wort; and is a thick-leaved sort of *fucus* or sea-wrack. Kali is a species of this plant. Kelp is thrown on the shores of Scotland in great abundance, and before the method of obtaining soda from common salt was introduced, the manufacture of kelp was largely carried on. From kelp, iodine is prepared by exactly the same process as that by which bromine and chlorine are obtained from the bromides and chlorides, viz., by heating with sulphuric acid and manganese dioxide.

KILOGRAMME. A thousand grammes, equal in weight to 5 drachms and a half. *See* METRIC SYSTEM.

KILOLITRE. A thousand litres. *See* METRIC SYSTEM.

KILOMETRE. A thousand metres. *See* METRIC SYSTEM.

LAC, OR GUM-LAC. A concrete brittle substance (not a gum, although sometimes so called, but a resin), deposited on different kinds of trees in the East Indies, by a species of insect of the cochineal kind. That sort of lac known as stick-lac is the wax adhering to small sticks or branches, and is unprepared. The lac when separated from the sticks, finely powdered, and deprived of its colour for the sake of the dyes, and other purposes, is called seed-lac. When the stick-lac is freed from its impurities by melting over a gentle fire and moulded into cakes, it is known as shell-lac. With lamp-black or vermilion it forms black or red sealing-wax. In solution with borax, and coloured with lamp-black, it constitutes Indian-ink. Dissolved in alcohol and other menstrua, it forms various kinds of lacquers and varnishes.

LACMUS. *See* LITMUS.

LÆVULOSE. *See* GLUCOSE.

LAMP BLACK. A colour procured by the condensation of the smoke of burning pitch, or some resinous substance, in a chimney terminating in a cone of cloth.

LANDSCAPE (*Ger.*) The landscape

photographer requires a thorough knowledge of the rules of art, a fine artistic feeling, and considerable technical skill. In the composition of the subject, or the selection and combination of certain natural objects, and the arrangement of the light which most favourably clothes them with colour, artistic knowledge and feeling are necessary. Some motive or intention is to be embodied in the picture, if it is intended to produce a work of art. To faithfully carry out the intention of the artistic mind manipulative skill of no mean order is requisite. The consideration of rules guiding the landscape photographer might well occupy a volume, but the space at our disposal will permit but of the most brief reference to them. As we have said, the picture should embody some story. Harmonious balance of light and shade should be maintained, with proper balance of the lines of the composition. These should, in addition to being true to the rules of art, all subserve to the chief object of the work, pointing to and emphasizing the most important portion of the work. An object of mean importance must never, by prominence in position, or brightness of colour, be permitted to monopolize attention. The general characteristics of an effective view may, briefly given, be said to consist in good, bold, springing lines properly compensated and balanced; a middle distance merging harmoniously into the lines of distance. The sky in its lines and masses of light and shade must be true to the work, and may be used to supply contrast which is unavoidably lacking in the picture and serve to complete harmony of the whole. The foreground, which is more thoroughly under the control of the artist, may be arranged to subordinate and bring into harmony those parts of the picture over which the artist has not immediate control. There should be one central point of interest, to the bringing into prominence of which every line and the massing of light and shade should tend. The rapid dry plates obtainable are a great power in the hands of the landscape photographer, and with them much of difficulty and uncertainty are done away with, and higher possibilities placed within his reach. The one great requirement of the photographer who would produce works of art, is artistic feeling.

LAPIS INFERNALIS (*Lat.*) Silver nitrate, *q.v.*

LATENT IMAGE. *See* IMAGE, LATENT.

LAURUS CAMPHORA. *See* CAMPHOR.

LEAD. Pb. 206·4. Lead does not occur free in nature; all the lead of commerce is obtained from *galena*, or lead sulphide, PbS. To reduce lead from this ore, the galena is roasted in a reverberatory furnace, with the addition of a small quantity of lime to form a fusible slag with any siliceous mineral matter present in the ore. By the action of the air a portion of the sulphide is oxidized to sulphate, whilst in another portion the sulphur burns off as sulphur dioxide, and lead oxide is left behind. After the lapse of a certain time air is excluded, and the heat of the furnace raised; the lead sulphate and oxide formed both decompose the remaining sulphide, giving off sulphide dioxide and leaving metallic lead behind. In pure water freed from air, lead preserves its lustre; but if air be present, lead oxide is formed, and this dissolving slightly in the water a fresh portion of metal is exposed for oxidation. This solvent action of water upon lead is a matter of much importance, owing to the common use of lead water-pipes, and the peculiarly poisonous action of lead compounds upon the system, even in minute quantities, for a length of time.

LEAD ACETATE, OR SUGAR OF LEAD. Prepared, by dissolving to saturation, litharge or protoxide of lead in acetic acid.

LEAD CHLORIDE, $PbCl_2$, is prepared by adding hydrochloric acid to a strong solution of lead nitrate, when a crystalline precipitate of lead chloride is formed. It dissolves in about thirty parts of boiling water, separating out in shining needles on cooling.

LEAD CHROMATE, $PbCrO_4$, a yellow insoluble salt, used as a pigment under the name of chrome yellow.

LEAD IODIDE, PbI_2, is precipitated in the form of splendid yellow spangles, when hot solutions of potassium iodide and lead nitrate are mixed and allowed to cool.

LEAD MONOXIDE, OR LITHARGE, PbO, a straw-coloured powder obtained by heating lead in a current of air; it fuses at a red heat, forming scaly crystals termed litharge or massicot.

LEAD NITRATE, $Pb(NO_3)_2$. The most important of the soluble salts of lead, obtained by dissolving the oxide, the carbonate, or metallic lead in warm nitric acid; it crystallizes in octohedrons, and dissolves in eight parts of cold water, and when heated strongly it yields red fumes of NO_2.

LEAD SULPHIDE, OR GALENA, PbS, is found native, and constitutes the chief ore of the metal. It is prepared as a black precipitate by passing sulphuretted hydrogen gas through a solution of a lead salt. Galena crystallizes in cubes and octohedrons, and possesses a bright bluish-white metallic lustre.

LEADEN PIPES AND CISTERNS. The solvent action of water upon lead, which was noted under the article "LEAD," is a matter of importance to the photographer, and the use of ordinary water held in a leaden cistern, or passing through leaden pipes had best be avoided for certain solutions requiring great purity of composition. The small quantity of certain salts contained in all spring and river waters exerts an important influence on the action of lead; thus waters containing nitrates or chlorides are liable to contamination with lead, whilst those hard waters containing sulphates or carbonates may generally be brought into contact with lead without danger, as a thin deposit of sulphate or carbonate is formed, which preserves the metal from further action. If the water contain much carbonic acid, it should not be allowed to come into contact with lead, as the carbonate dissolves in water containing this substance. The presence of lead in water may easily be demonstrated by passing a current of sulphuretted hydrogen through the acidified water, and noticing whether the liquid becomes tinged to a brown colour owing to the formation of lead sulphide. Potassium iodide gives a yellow tinge to water contaminated with lead; and sulphuric acid causes a white cloudiness.

LEAKAGE OF GLASS ROOF. The trouble and loss occasioned by a leaky skylight are very considerable, and the wisest plan is to have a defective glass roof thoroughly repaired, rather than run the risk of spoiling apparatus and furniture of the studio. Tin gutters should be fitted to the ridges inside, to carry off any water which may come through to the outside gutter. The over-lappings of the glass must be held apart sufficiently with a piece of tin, so that the capillary action of the overlapped glasses may be avoided.

LEAST CIRCLE OF ABERRATION. *See* FOCUS.

LEAST CONFUSION, CIRCLE OF. *See* FOCUS.

LEATHER, PICTURES ON. *See* COLLODION POSITIVES.

LEAVES, PRINTING FROM. *See* FERNS.

LENS (*Lat.*) A lens is a piece of glass, rock-crystal, or other transparent substance, bounded on one side by a polished spherical surface, and on the other by a spherical or plane surface. Lenses refract the rays of light which pass through them, either bringing them to a focus, if they are converging lenses, or spreading them out if they are diverging lenses. According to their curvature they are either spherical; cylindrical, elliptical, or parabolic. Those used in optics are spherical; they are commonly made either of crown glass, which is free from lead, or of flint glass, which contains lead, and is more refractive than crown glass. The combination of spherical surfaces, either with each other or with plane surfaces, gives rise to six kinds of lenses; four formed of two

spherical surfaces, and two of a plane and a spherical surface. Three, which are thicker at the centre than at the borders, are converging; other three, which are thinner in the centre, are diverging. The first-named group includes the double-convex, plano-convex, and converging concavo-convex, or as it is sometimes called, the converging meniscus. Of the second group we have the double concave, the plano-concave, and the diverging concavo-convex, or diverging meniscus. In lenses with two spherical surfaces, the centres of those surfaces are called centres of curvature, and the right line which passes through those two centres is the principal axis. In a plano-concave or plano-convex lens, the principal axis is the perpendicular let fall from the centre of the spherical face on the plane face. No single lens is free either from spherical or chromatic aberration. These errors are corrected by the combination of two or more lenses. In correcting for spherical aberration, the same kind of glass may be used for both lenses; but to cure chromatic aberration, the lenses combined in contact must be of different kinds of glass.

LENS, ACTINIC FOCUS OF. *See* ACTINIC FOCUS.

LENS CAP. The cap of the lens should be kept carefully. It should not fit the lens too tightly, or in removing it for exposure of the plate the box is shaken.

LENS, CARE OF. Lenses should be kept under cover when out of use, either by capping or by being placed in a case or box. Dust must be brushed from the surface with a camel's-hair brush, and only wiped when the brush fails to remove the dust. Keep the lens as much as possible in a dry atmosphere. Whenever moisture appears on the surfaces (*See* DEW POINT), remove it by gently wiping with soft cambric, never with paper, however soft.

LENS, DIAPHRAGM FOR. *See* DIAPHRAGM.

LENS, FOCUS OF. *See* FOCUS.

LENS, FOCUS OF, TO TEST. *See* ACTINIC FOCUS, TO FIND.

LENSES, MOUNTING. It is advisable to mount all the lenses used in the gallery on boards of uniform size, and to have the cameras fitted with grooves to receive any board. It is sometimes necessary to use a lens in a camera other than that for which it is intended, and there is much trouble and loss of time in changing; and in repeated screwing and unscrewing, serious wearing of the thread of the screw. All this is obviated by the use of boards which fit places on the front of the cameras. The change by this means may be made in a moment. There is no screwing to the front of the camera required, and consequently a change of lens does not mean the unfixing of one lens and the screwing on of another. The wear and tear of the lenses and cameras are materially reduced, and of consequence they last longer, and are always in better condition.

LEVULOSE. *See* GLUCOSE.

Li. The chemical symbol of Lithium.

LICHTDRUCK. *See* MECHANICAL PROCESSES.

LIGHT (*Lat.*) The agent or force which, by its action on the retina, excites in us the sensation of vision. Various hypotheses have been made to explain the origin of light, the most important of which are the emission or corpuscular theory, and the undulatory theory. On the emission theory, light is supposed to be due to the shooting out from the luminous body of an infinite number of small particles with inconceivable velocity. Penetrating into the eye they act on the retina, and determine the sensation which constitutes vision. On the undulatory theory, all bodies as well as the celestial spaces are filled with an extremely subtle elastic medium which is called the luminiferous ether. The luminosity of a body is due to an infinitely rapid motion of its molecules, which, when communicated to the ether is propagated in all directions in the

form of spherical waves, and this vibratory motion being thus communicated to the retina calls forth the sensation of vision. The vibrations of the ether do not take place in the direction of the wave, but in a plane at right angles to it; and are called the transversal vibrations. An idea of these may be formed by shaking a rope at one end, the to-and-fro movements of the particles of the rope are at right angles to the length of the rope, but the onward motion of the wave's form is in the direction of the length. The undulatory theory of light not only explains the phenomena of light, but it reveals an intimate connection between these phenomena and those of heat and sound, due allowance being made for the difference of media in which the respective phenomena take place. Light passes through transparent objects, whilst it is arrested by opaque bodies, casting shadows. When it falls upon a light opaque body with a rough surface it is dispersed and scattered about in all directions. When it falls upon a highly polished surface it is reflected back, the angle of reflection being equal to the angle of incidence. When it passes obliquely from one transparent medium to another of different density, it is bent out of its course, or refracted, and at the same time dispersed into different colours constituting the spectrum. When a ray of light just grazes the edge of a dense substance in its path it is inflected. Reflected from a polished surface at a particular angle it is polarized, acquiring new properties. Similar phenomena of polarization are produced when common light is passed through certain crystals which possess the property of double refraction. Light may be produced by chemical action, by phosphorescence, by great heat, by crystallization, and it issues from celestial bodies, such as the sun and stars, which shine by their own light.

"LIGHT." A term sometimes applied to the glass roof of the gallery. *See* GLASS HOUSE.

LIGHT, ARTIFICIAL. *See* ARTIFICIAL LIGHT.

LIGHT, FRONT. *See* FRONT LIGHT.

LIGHT, HIGH. *See* HIGH LIGHT.

LIGHT, HOMOGENEOUS. *See* HOMOGENEOUS LIGHT.

LIGHT, INTERFERENCE OF. *See* INTERFERENCE OF LIGHT.

LIGHT, MONOCHROMATIC. Light of one refrangibility, and consequently of one colour.

LIGHT, SIDE. *See* SIDE LIGHT.

LIGHT, THEORIES OF THE ACTION OF. *See* IMAGE, LATENT.

LIGHT, TOP. *See* TOP LIGHT.

LIGHTING THE SITTER. The lighting or illumination of the sitter is a most important consideration in artistic portraiture. By skilful management of the illumination, the artist is not alone enabled to bring out points of character in the sitter, but to produce charming effects of chiaroscuro; in fact, to make, instead of a bare, if not repulsive, representation of the sitter, a pleasing work of art. Quite as much as in handling of brush and colours by the painter are certain methods of managing the illumination characteristic of individual workers in photography, and by the style we may almost invariably recognize the hand of the producer. The importance of forming the practice of lighting on true principles of art is not to be over-estimated. As beauty and likeness are brought out by observance of these rules, disregard of them is fatal to truth and picturesqueness. It will be only possible here to briefly review the means at the disposal of the photographer, and to give a few hints on the best use of them; the rest must be left to individual study of art examples and practice. Three kinds of light are used in photographic lighting: diffused, direct, and reflected. Of these, diffused light plays the most important part. Too much diffused light tends to flatten the image and rob it of all force, character, and roundness. For this reason a great expanse of glass through which we obtain our light is bad. Blinds remedy the fault to a certain extent, but not wholly; the best por-

traits being produced under a small light where blinds are necessary only under exceptional circumstances. Direct rays light up the prominent points of the face and enliven the effect, producing what are known as high-lights. Reflected light is useful for illuminating heavy shadows where detail would otherwise be lost. Without it the shaded side would be flat and black. The greatest care must be exercised that the reflected light is not too strong, or modulation will be lost. A well-lighted head will be reproduced on the sensitive plate in perfect gradation of tone from the high-light, appearing as almost pure white, down to a point of almost pure black, forming the centre of the deepest shadow. Where there is any white in a face beyond the specks of high-lights, the illumination may be invariably judged at fault, unless the negative has been injudiciously strengthened. It may be noted here that with a properly lighted object, a negative sensitized in an ordinarily pure bath needs no intensification. Fault in this respect of lack of intensity is only due to the lighting. The mode of lighting from the back of the subject, known generally as the Rembrandt Effect, *q.v.*, should not be used indiscriminately, but only where it is suitable, and as it enhances beauty or likeness. Against the too general practice of charging extra for Rembrandt pictures, the most vigorous protest should be raised. Not only is the practice manifestly unfair, but it is prejudicial to the artistic development of photography. Whether a sitter cares to pay the extra charge for an unsuitable style of picture, or another sitter for whom it would be a becoming style is debarred by reason of expense, an injury is done to art.

LIKENESS. A term used to express the characteristic appearance and individuality of the sitter.

LIME (*Lat.*) CaO. Calcium monoxide.

LIME CARBONATE. $CaCO_3$. Calcium carbonate. This salt occurs most widely diffused, as limestone, chalk, marble, and coral; many of these enormous deposits being made up of the microscopic remains of minute sea-animals. Calcium carbonate exists crystalline as calc-spar, or Iceland spar, and also in a different form—arragonite; so that it is dimorphous. The carbonate is almost insoluble in pure water, but readily dissolves when the water contains carbonic acid. Useful in photography in depriving the solution of gold chloride of excess of hydrochloric and nitric acids.

LIME CHLORIDE, OR BLEACHING POWDER, is a mixture of calcium chloride and calcium hypochlorite, and is obtained by the action of chlorine upon slaked lime. Sometimes used in the gold toning bath to neutralize the acidity of the solution. Also in the process of fuming when the paper turns yellow in damp weather, a small quantity placed in the ammonia dish counteracts the tendency. The use of the chloride in photography is limited on account of its bleaching qualities; whatever advantage attending its use being counterbalanced by the feeble prints produced in its presence.

LIME-LIGHT. *See* ARTIFICIAL LIGHT.

LIME TONING BATH. *See* TONING.

LINEN, PHOTOGRAPHING ON. *See* PRINTING ON LINEN, &c.

LINSEED OIL. Obtained from the seed of the flax plant by pressure. Sometimes used in spirit varnishes to reduce their brittleness.

LIQUEFACTION (*Lat.*) Act of melting; state of being melted.

LIQUID (*Lat.*) Fluids have been divided into two classes, viz., those which are elastic, and the non-elastic, or those which do not sensibly diminish in bulk when subjected to pressure. Of the first are airs or gases; the second, liquids; hence we may define a liquid to be a fluid not sensibly elastic, the parts of which yield to the smallest pressure and move on each other.

LIQUID GLUE. *See* GLUE, LIQUID.

LIQUOR AMMONIÆ. *See* AMMONIA.

LIQUOR POTASSÆ. Aqueous solution of potash. *See* POTASSIUM HYDROXIDE.

LITHARGE. *See* LEAD MONOXIDE.

LITHIUM. Li. 7·01. Prepared by decomposing the fused chloride by electricity. It is of a white colour, fuses at 180°, and is the lightest metal known. The lithium salts were formerly supposed to be very rare, only being known to occur in three or four minerals; but spectrum analysis has shown that it is a widely-distributed substance. In its chemical relations, lithium stands between the class of alkali and alkaline earth metals.

LITHIUM IODIDE, LiI., is sometimes used in photography on account of its ready solubility in alcohol. It is, however, so deliquescent that it is with difficulty preserved in a dry state.

LITHOGRAPHY, PHOTO-. *See* MECHANICAL PROCESSES.

LITMUS. A vegetable colouring matter extracted from various species of *Roccella Tinctoria*, &c. It is coloured blue by alkalis, and red by acids, and is, on this account, much used in the preparation of test-papers, *q.v.*

LITMUS PAPER. *See* TEST PAPERS.

LITMUS PRESERVATIVE. *See* EMULSION PROCESSES.

LITRE. A measure of capacity in the system of French measures; containing one thirty-fifth of an English bushel.

LIVER (*A.S.*) Certain compounds which, from their massiveness and outward appearance, have been compared to the liver; as the liver of sulphur and of antimony. The liver of sulphur is used in the reduction of silver residues from sodium hyposulphite baths, &c. *See* WASTE, REDUCTION OF.

LIVER OF SULPHUR. *See* HEPAR SULPHURIS.

LOGWOOD. Dye wood so called. Obtained from the *Hæmatoxylon Campeachianum*. Very dense and firm in structure, exceedingly heavy, so as to sink in water. Of a deep red colour. It yields its colour both to spirituous and watery menstrua; but alcohol extracts it more readily than water. Acids turn the dye to yellow; alkalies deepen its colour, and give it a purple or violet hue. It gives purples and blues and blacks of various intensities by means of iron and alum bases. Its colouring matter is called hematin. Decoction of logwood absorbs oxygen from the atmosphere, and will then precipitate gelatine, a property it did not at first possess.

LONG EXPOSURE. For wet plates which are to be subjected to long exposure in the camera, albumenize the glass, and coat with a spongy collodion. It is sometimes advisable to pour the collodion over the plate two or three times. The sensitizing should be not quite complete, the plate being withdrawn before the greasy appearance has disappeared. Place wet blotting-paper behind the plate in the holder, and keep the camera cool by placing a wet cloth inside.

LUNAR CAUSTIC. Silver nitrate fused and cast into sticks.

LUTE (*Lat.*) Composition like clay, used for closing up the necks of retorts, reservoirs, &c., to prevent the escape of liquids when submitted to certain chemical operations, as distilling, &c.

LUXOGRAPH. *See* ARTIFICIAL LIGHT.

MACERATION (*Lat.*) The process of obtaining the virtues of bodies by soaking them in fluids. It differs from digestion only as the latter is effected by the application of heat.

MACHINERY, PHOTOGRAPHING. Generally pictorial effect is quite secondary in importance to some point of note in the machine. It is necessary, therefore, to obtain definite knowledge of what this is, so that it may be brought out. The illumination of a workshop is seldom suitable, but by cleaning windows and using reflectors much may be done. Windows which appear in the view, however, cannot be too dirty;

sometimes it is well to cover them with a cloth. As much of the machine as allowable should be coloured white; the polished portions being left. Focus sharply on the most important spot. A pure sensitizing solution is required; the plate under sensitized, withdrawn before the greasy marks have entirely disappeared, and having two or three sheets of wet blotting-paper at the back of the plate during the exposure, and drying marks need not be feared. Use a strong developer and plenty of alcohol. After a long exposure, flood the plate with developer to insure the solution touching every part.

MACRO-PHOTOGRAPHY. The enlargement of the image of the negative in the solar camera. *See* PRINTING IN THE SOLAR CAMERA.

MAGIC LANTERN. An apparatus by which a magnified image may be projected on a white screen in a dark room. It consists of a tin box, in which there is a lamp placed in the focus of a concave mirror. The reflected rays fall upon a condensing lens which concentrates them on the glass plate or slide. A double convex lens, at a distance from the slide of rather more than its focal distance, and consequently, a real and very much magnified image of the picture on the glass slide, is cast upon the screen. Dissolving views are obtained by arranging two magic lanterns which are quite alike, with different pictures, in such a manner that both pictures are produced on the same portion of the screen. The object glasses of both lanterns are closed by screens, so arranged that according as one is raised the other is lowered, and *vice versa*. In this way one picture is seen to gradually melt into the other. Photographic slides for the magic lantern may be produced from negatives, on wet or dry plates, in the camera, or in the printing frame. *See* TRANSPARENT POSITIVES. The slides for the lantern may be painted in transparent colours ground in Canada balsam.

MAGIC LANTERN SLIDES. *See* TRANSPARENT POSITIVES.

MAGIC PICTURES. An ingenious process discovered by Sir John Herschel, by which an invisible image may be developed immediately, as if by magic. Print as usual on plain or albumenized paper under a negative, and fix in sodium hyposulphite, without toning the print. Wash thoroughly, and immerse in a saturated solution of mercuric chloride until the image entirely disappears. Wash thoroughly and dry. To bring out the picture a piece of blotting-paper previously saturated in sodium hyposulphite is wetted with common water, and pressed over the print, on which the picture instantly starts out with more than its original vigour.

MAGLIP. A glutinous compound made by mixing boiled oil and mastic varnish; used for thinning oil colours and for glazing on delicate tints in finishing the picture in oil colour.

MAGMA. The generic name of any crude mixture of mineral or organic matters, in a thin pasty state.

MAGNESIA. *See* MAGNESIUM OXIDE.

MAGNESIUM. Mg. 23·94. Occurs in large quantities as carbonate along with calcium carbonate in dolomite or mountain limestone, and also in sea-water and certain mineral springs as chloride and sulphate. The metal is best obtained by heating magnesium chloride with metallic sodium, sodium chloride and metallic magnesium being formed; this metal is of a silver white colour, fuses at a low red heat, is volatile, and may easily be distilled at a bright red heat. When soft, it can be pressed into wire, and with care may be cast like brass, although when strongly heated in the air it takes fire and burns with a dazzling white light, with the formation of its only oxide, magnesia. The light emitted by burning magnesium wire is distinguished for its richness in chemically active rays, and this sub-

stance is therefore employed in photography as a substitute for sunlight, and has been successfully employed for photographing the interior of the Pyramids, caverns, &c.

MAGNESIUM CHLORIDE. $MgCl_2$. A fusible salt obtained by evaporating magnesia dissolved in hydrochloric acid with an equal quantity of sal-ammoniac; on fusion, the latter salt volatilizes, and the magnesium chloride remains behind.

MAGNESIUM LIGHT. *See* ARTIFICIAL LIGHT.

MAGNESIUM, OR MAGNESIA. MgO. A light, white infusible powder, obtained by heating the carbonate or nitrate. It unites with acids to form the magnesium salts, but does not possess a strong alkaline reaction.

MAGNESIUM SULPHATE. $MgSO_4 + 7H_2O$. A valuable substance known as Epsom Salts; occurs in a spring in Surrey, and contains seven atoms of water of crystallization. It is now largely made from dolomite by separating the lime with sulphuric acid. Magnesium sulphate forms, with the alkaline sulphates, double salts, in which the alkaline sulphate takes the place of one molecule of water of crystallization.

MALT PRESERVATIVE. *See* DRY PLATE PROCESSES.

MANGANESE DIOXIDE, OR BLACK OXIDE. MnO_2. A neutral substance, occurring as the ore of manganese in the minerals pyrolusite and varvacite; finds use in photography as a source of oxygen gas for the purposes of artificial light.

MANIPULATION. A general term used to express the conduct of a photographic operation or process.

MANIPULATIONS, IMPERFECTIONS IN THE. *See* under special headings of the manipulation or process.

MARBLED STAINS on the negative are due to the drying of the film before, or during exposure. If the exposure is long, or the weather warm, it is a good plan to place two or three thicknesses of blotting paper, saturated in water, at the back of the plate to prevent too rapid evaporation.

MASKS AND DISCS. In a piece of blackened paper an oval or other form of opening is cut. The outside margin, or mask, is placed between the negative and the sensitized paper in the printing frame, stopping the action of the light at the margin of the picture. A print of the shape of the opening of the mask is thus formed, the rest of the paper being white. Oval and other masked prints are often finished at this stage; but the effect of the work is much improved by placing the disc or piece of paper cut from the mask, over the printed portion of the sensitized paper, and darkening the margin slightly, by exposure to light. The disc should be gummed to a sheet of glass, when it may easily be placed in position on the print. By placing the disc a trifle over the edge of the print, or in other words showing a little of the print on one side, a faint white line is obtained on one side of the print, and a darker line on that portion of the print thus twice exposed. These papers are known by a variety of names, as cut-outs, forms, shapes, &c., and according to design, oval-forms, arch-top forms, oblong-forms, ornamental-forms, &c., &c.

MASSICOT. *See* LEAD MONOXIDE.

MASTIC, OR MASTICH; a solid and transparent resin, of a pale yellow or whitish colour, principally brought from the island of Chios, in drops or tears about the size and form of a pea, as it naturally forms itself in exuding from the mastic tree. It should be clear, pellucid, and of a pale yellowish colour, well scented, and brittle. Used as an ingredient in drying varnishes.

MATRIX (*Lat.*) The bed or mould of earth, etc., in which any mineral substance is formed.

MATTER (*Fr.* and *Lat.*) That which is the object of our senses, the distinguishing property of which is its power of resisting any attempts to make it change its state. Matter is usually divided into three classes, viz., solid, liquid, and aëriform. Solid substances

are those whose parts firmly cohere or resist impression, as wood or stone; liquids have free motion among their parts, and easily yield to impression, as water and wine. Aëriform substances are elastic fluids called vapours and gases, as air and oxygen gas.

"MEALINESS" OF THE PRINT. A term used to describe the appearance of an irregularly toned print, where small spots of irregular shape are formed on the image, with a general lack of vigour. The fault arises principally from a badly mixed toning bath, or one in which there is little gold. Sometimes, however, it is attributable to the paper.

"MEASLES" IN PRINTING. Imperfect fixation gives rise to a mottled appearance in the print. On being held up to the light the paper is seen to be speckled over with opaque blotches, which after a while turn yellow. The action of light during the operation of fixing also causes the deposit; but the principal causes are weakness of the solution of sodium hyposulphite and its acid condition. *See* FIXING.

MEASURES (*Fr.* and *Lat.*) *See* WEIGHTS and MEASURES.

MECHANICAL PROCESSES.—ALBERTYPE. In this process a thick glass plate is coated with warm gelatine, ammonium bichromate, and albumen; exposed to the light and rendered insoluble in water. The film is then covered with gelatine isinglass, potassium bichromate, and resinous matter in alcohol. When dry it is placed under a negative and exposed. Tepid water dissolves the soluble parts, leaving in relief those where light has acted. The plate when dried is oiled and inked with a lithographic roller. ASPHALTUM PROCESSES, in which advantage is taken of the property possessed by asphaltum of becoming insoluble in oil of lavender and other solvents, after exposure to light. The metal plates are then bitten with acid, which attacking the parts unaffected by light leaves the image in relief. With other than subjects in lines a grain is communicated to the plate by the application of powdered resin, which, when heated, forms a network over the surface. With the "Asphaltotype" the names of Niepce, de Saint Victor, Amand Durand, and others are connected. The plates of glass, sometimes used, were etched by placing them, face downwards, over the fumes of hydrofluoric acid. AUBELDRUCK. A secret process, but supposed to consist in some method of glass etching, so that prints may be from it obtained direct, or from a stone to which an impression has been transferred. COLLOTYPE PROCESSES. Various processes based on the principle of the insolubility in water of bichromated gelatine after exposure to light. DAGUERREOTYPE ETCHING. Many attempts have been made to engrave the delicate photographic image of the Daguerreotype plate; by dilute nitric acid, which attacked the shadows of the image, and left in relief the parts protected by the mercury; by dilute muriatic acid, and after depositing gold on the lights, by further biting down with nitric acid; by etching with the acid of the galvanic battery, &c., &c. These failed from the difficulty of obtaining sufficient relief of the image and the requisite "grain." Donné, Grove, Fizeau, and others were the experimenters in this direction. DALLASTINT. *See* TYPOGRAPHIC PROCESSES in this article. ELECTROTYPING PROCESSES. In most of these processes the printing plate is obtained by depositing copper on the gelatine relief obtained by the agency of light, or on casts from the gelatine. The processes are based on two principles: one by which a film of chromated gelatine exposed under a negative, the parts not acted upon by light are dissolved away by the action of hot water, and those parts where light has set up an action and rendered the gelatine insoluble, an image in high relief is formed. From this a cast or electrotype may be made. The other, by using cold water, the gelatine absorbs moisture, and swells in those parts protected from light, and only slightly in the parts acted upon

by light. Pretsch, Placet, Geymet, Fontaine, Avet, Drivet, Andra, and others developed processes similar in principle. Nègre used both asphaltum and bichromated gelatine, and obtaining an impression under a positive after washing, deposited a film of gold on the image. ETCHING PROCESSES WITH GELATINE. Talbot's photographic engraving process was based on the property of gelatine mixed with an alkaline bichromate becoming impermeable to certain fluids in proportion to the intensity of the action of light upon it. Steel plates, coated with a thin film of gelatine and potassium bichromate, after exposure under a negative, were etched with platinum bichromate. The process bore the name of "photoglyphy." M. Baldus used a copper-plate, and etched with ferric chloride, rolling up the relief with printer's ink from time to time, to protect the gelatine from the action of the etching fluid. HELIOTYPE PROCESS. Gelatine soaked in hot water, with sufficient potassium bichromate to render it sensitive, and chrome alum added for durability; with this mixture a waxed glass plate is coated. Stripped from the glass, the film is exposed under a reversed negative. This film is attached to a metal plate and soaked in water. The plate is then printed from in the lithographic press. LICHTDRUCK. A process in which an image is secured on a film of bichromated gelatine, and treated after the same manner as the Albertype, heliotype, &c. LITHOGRAPHIC PROCESSES WITH ASPHALTUM. The earliest experiments of Niepce, in connection with Barreswill, Lemercier, Lérebours, and Davanne were by the use of asphaltum dissolved in ether or in essential oils. The asphaltum evenly spread over the lithographic stone is sensitive to light, and when the parts not acted upon by light have been removed by washing with a solvent, the image in asphaltum receives the ink in a similar manner to an ordinary lithographic drawing. LITHOGRAPHIC PROCESSES WITH GELATINE. In Poitevin's process the stone is coated with a mixture of albumen and potassium bichromate, and exposed to light under a negative. On the removal of the negative the stone is moistened with water, and inked over as in lithographic printing, the ink adhering only to those portions affected by light. From the discovery made by Poitevin when perfecting his process, that the gelatine image swelled under certain conditions when treated with water, sprang the process of producing electrotype plates for printing in the usual manner. OBERNETTER'S PROCESS. The exposed gelatine-coated plate is covered with an impalpable metallic zinc powder, and heated. It is then submitted to the action of weak hydrochloric acid, and well washed. The parts of the gelatine film covered with the metallic powder can be damped, and therefore refuse the greasy ink. This process is worked in America as the "Artotype," *q. v.* PAPYROGRAPHY. A process for obtaining a few prints without the labour of preparing a stone or metal plate. The negative is made by presenting the glass side to the object, if it is of importance that the parts be not laterally inverted. On a sheet of paper coated with bichromated gelatine, a positive picture is prepared in carbon ink, laterally inverted. This is placed face downwards on a sheet of paper and passed through a lithographic press, by which a sharp and clean impression is obtained. PHOTO-GALVANOGRAPHY. Pretsch's process for the production of copper plates by the joint action of light and electricity. A glass plate is coated with bichromated gelatine, dried and exposed under a positive print. The picture upon the gelatine is developed in raised and sunk parts by immersion in water. A mould is taken in gelatine, from which, by means of the electrotype process, a copper-plate is made. The copper-plate from which the proof is to be printed, is now obtained from the matrix by the electrotype process. PHOTOGLYPTY—PHOTOTYPY. The plates are coated with gelatine fifteen parts, to water one hundred parts, and dried. Immerse two minutes in

ferric chloride, fifty grains; tartaric acid, eighteen grains, water four ounces, and dry in the dark. Expose under a positive or transparent print. The iron salt is eliminated by copious washing in cold water, and where the light has traversed fatty ink will not combine. PHOTO-GRAVURE. A process acquired by M. Goupil, the well-known art publisher, has given some of the finest specimens of photographic mechanical work ever exhibited. A bichromated gelatine film, having a slight admixture of Indian ink, is exposed under a negative and treated as in printing, and developed by the carbon process. The leaf is covered with india-rubber varnish, and placed for twenty-four hours in tepid water to dissolve the soluble gelatine. By hydraulic pressure an impression is taken in lead. The prints are rendered insoluble by immersion in an alum bath. SCAMONI'S PROCESS. A negative from a drawing or line subject is prepared, and from this a positive in the camera by the wet process. After fixing, by various re-developing operations a degree of relief is obtained. The plate is then varnished and coated with fine plumbago, and electrotyped. TALBOT'S PROCESS. Plates of copper, steel, or zinc are first washed over with a dilute solution of sulphuric acid, and then well rubbed with a mixture of carbonate of soda, and well dried. The plate is then coated with bichromated gelatine, dried by heat until the film assumes a beautiful yellow colour. Exposure under a negative or transparent print will produce a yellow image on a brownish ground. Two or three minutes' exposure to the sun's rays will ordinarily suffice. The film is then uniformly covered with very fine copal or resin powder, which communicates granulation to the film. The resin is now melted by placing the plate over the flame of a spirit lamp. The plate is cooled and etched by pouring over it a solution of sesquichloride of iron in water. After a minute or so the engraving begins to show itself by turning dark brown or black, the detail appearing with great rapidity. When complete the fluid is wiped off with a pad of wool, and the plate washed in water. Detail may be brought out in parts by applying fresh etching fluid by means of a camel's-hair pencil. TYPOGRAPHIC PROCESSES. By a method used by Poitevin, a film of bichromated gelatine is prepared and exposed under a negative, and by cold water the parts not acted upon by light are swelled, so that a delicately modelled reverse of a typographic block is obtained. From this a cast is made, which is reproduced in metal. By another method a sensitive film of bichromated gelatine or asphaltum is exposed, and an image formed on a metal plate. The plate is then subjected to the action of an etching fluid. Another method is that in which a photographic transfer is made on a metal plate, and then bitten in. The plate is frequently rolled up with printer's ink, dusted with powdered resin, and heated, and after each application of ink and resin subjected to the action of the acid. This last method is that generally known as *Gillotage*. Many attempts have been made to secure blocks in half tint, the most successful, perhaps, being the Dallastint. The process is a secret one. WOODBURY PROCESSES. The results obtained by the several ingenious processes of Mr. Woodbury are of very great beauty. Charcoal, fine emery, or powdered glass mixed with the bichromated gelatine gives grain to the cliche, which is obtained from the impression of the gelatine image in soft metal. By another process paper is coated with three or more mixtures of gelatine, potassium bichromate, and some granular substance; exposed under a negative, transferred under water to a finely polished metal plate, and washed in warm water. When dry, an impression is made on soft metal. ZINCOGRAPHIC PROCESSES. By Col. Sir Henry James's process a suitable paper is coated with bichromated gelatine, dried, and recoated. Exposed

under a negative for about a minute in bright light, and inked with lithographic ink mixed with linseed varnish, to which has been added a preparation of Burgundy pitch, 2 ounces; palm oil, 1 ounce; beeswax, 1 ounce; thoroughly mixed during melting by stirring. The ink thinned somewhat with turpentine is spread over a flat zinc plate, and the print placed upon it face downwards and passed through a press, by which it receives an even coating of ink. The paper is then removed and placed, face upwards, in water; and the superfluous ink afterwards removed with a wet sponge. The paper is dried, and the image transferred to a zinc plate, by placing it face downwards on the plate, and passing it through the press. The paper is removed, and the transfer etched with a decoction of galls and a little sulphuric acid, mixed with a thick solution of gum in water.

MEGASCOPE (*Gr.*) An instrument for making magnified drawings of objects.

MELAINOTYPE. The style of the first pictures made on iron plates before the title of ferrotype was generally adopted. *See* COLLODION POSITIVES.

MENISCUS (*Gr.*) A lens having one convex and one concave surface, the convexity exceeding the concavity. It acts as a convex lens, bringing incident parallel rays of light to a focus.

MENSTRUUM (*Lat.*) Any fluid or subtilized substance which serves to extract the virtues of a solid body by infusion, decoction, &c. Plural *Menstrua*.

MERCURIC CHLORIDE, OR CORROSIVE SUBLIMATE, $HgCl_2$, is prepared on a large scale by heating an intimate mixture of equal proportions of mercuric sulphate and common salt; it is also found when mercury burns in chlorine. It acts as a violent poison. It is soluble in water, crystallizing in rectangular octohedrons; more soluble in ether and alcohol. Fuses at 265°, and boils at 295°. Sometimes used as an intensifier; a saturated solution poured over the film until the image becomes of a grey colour. Wash, and pour over the negative a one-grain solution of potassium iodide, on which a greenish tint shows. Exposure to light, however, will, after a time, render the negative too intense.

MERCURIC NITRATE, $Hg(NO_3)_2$, is formed by the action of excess of nitric acid upon mercury, or the oxide.

MERCURIC OXIDE, OR MERCURY MONOXIDE, HgO, is obtained by modes rately heating the nitrate, or by heating the metal in the air for some time at a temperature of 300°. The oxide thus prepared appears as a red crystalline powder; by precipitating it from a solution of the nitrate by caustic potash it falls as an amorphous yellow powder.

MERCUROUS OXIDE, Hg_2O, is obtained as a black powder by digesting calomel with excess of caustic potash. On exposure to light, or when heated to 100°, it decomposes into mercury and mercuric oxide.

MERCURY. Hg, 199·8, occurs in the native state, but the chief ore of mercury is the sulphide or cinnabar. The metal is easily obtained by roasting the ore, when the sulphur burns off as the dioxide, and the metal volatilizes, and its vapour is condensed in earthen pipes. Mercury is the only metal liquid at the ordinary temperature; it freezes at −40°, crystallizing in octohedrons; in the solid state it is malleable. Mercury, when pure does not tarnish in moist or dry air, but when heated above 300° it slowly absorbs oxygen, passing into the red oxide, and it combines directly with chlorine, bromine, iodine, and sulphur. Hydrochloric acid does not attack mercury; sulphuric acid, on heating, forms sulphur dioxide, and mercuric sulphate; and nitric acid evolves nitric oxide, and forms mercuric nitrate. Mercury is largely used in the processes of extracting gold and silver from their ores, in the arts, for silvering mirrors, and other purposes.

MERCURY BATH. The box in which Daguerreotypes were developed by the fumes of mercury.

MERCURY FULMINATE. *See* FULMINIC ACID.

MERCURY SUB-CHLORIDE, OR CALOMEL $Hg_2 Cl_2$. A salt formed in the positive collodion process, when chloride of mercury in solution is poured over the picture.

METALLIC SILVER, TO REDUCE BATH TO. *See* NEGATIVE, and POSITIVE BATH, TO RESTORE.

METALLIC SPOTS in paper are formed in drying the sheet; rust from the drying stove, &c., in the albumenizing or printing rooms settling on the sheet, and causing troublesome defects.

METALLOIDS (*Gr.*) Non-metals. *See* METALS.

METALS. (*Lat.*) The elements are broadly divided into two classes, metals and non-metals, which merge by almost insensible gradations one into the other; so that it is impossible to give any definition of a metal which will not, in some way, either include substances decidedly non-metallic or exclude some metallic bodies. A metal is usually supposed to be heavy, opaque, solid, malleable, ductile, tenacious; to possess good conducting power for heat and electricity; and to have a peculiar lustre, known as the metallic lustre. But very few metals possess all these properties, while some bodies, which are decidedly non-metallic, possess many of them. Thus, as far as density is concerned, the alkali metals are lighter than water. Mercury is only solid at a low temperature, opacity is probably dependent only on mass, as films of gold, platinum, and other metals have been prepared so thin as to be almost as transparent as glass. Malleability is by no means a general property, and is especially absent in those metals approaching the non-metals in chemical properties, such as antimony, arsenic, and bismuth. Many metals have tenacity and ductility in a very inferior degree and in some they are entirely absent. The conducting power for heat and electricity varies through a very wide range, and is possessed by carbon to a much higher degree than by some metals. All metals possess the metallic lustre, but this is shared by some forms of carbon, by iodines, selenium, &c. The basic property of many metallic oxides is very strongly marked; in others it is very faint; whilst in other some it is entirely absent, and their oxides possess powerfully acid characteristics. The fusibility of metals is almost universal, although the limits are the widest, ranging between a temperature much below zero to the highest artificial temperature procurable. From the above it will be seen that whilst there can be no doubt about the position occupied by well defined metals, such as iron, silver, &c., and the non-metallic character of sulphur, nitrogen, and chlorine, when we take some of the intermediate bodies we find their properties verge one into the other in such a manner that it is impossible to draw a sharp line of distinction between metallic and non-metallic bodies.

METHYL ALCOHOL, $CH_3 OH$, commonly known as wood spirit, is procured in the dry distillation of wood, forming about one per cent. of the aqueous distillate; it is likewise met with in the oil of winter-green, derived from the *Gaultheria Procumbens*. Methyl alcohol is a colourless, mobile liquid, possessing a pure spirituous smell. Specific gravity is 0·8142 at 0°, and its boiling point is 66°; burns with a non-luminous flame, and is soluble in and miscible with water.

METHYLATED ALCOHOL. *See* ALCOHOL.

METHYLATED ETHER. *See* ETHER.

METHYLATED SPIRITS. *See* ALCOHOL.

METRE (*Gr.*) The French unit of length. *See* METRIC SYSTEM.

METRIC SYSTEM OF WEIGHTS AND MEASURES. First adopted in France, but now gradually coming into use in other countries. In the French system the fundamental unit is the *metre*, which is determined by reference to the length of a meridional circle. It is the ten-millionth part of the quadrant of the meridian of Paris. The length of a metre in

English inches is 39·3707898. This is nearly a quarter of an inch more than the length of a pendulum vibrating seconds of mean time in vacuum in the latitude of London, at the sea level; by reference to which is determined the yard, the fundamental unit of English measurement. The French unit of surface is the *are* of one hundred square mètres. The unit of capacity is the *litre*, the one-thousandth part of a cubic mètre. The unit of weight is the *gramme*, the weight of the ten-thousandth part of a cubic mètre of water at its maximum density. The kilogramme, or the weight of a litre of such water, is, however, commonly employed as more convenient. The value of these units does not depend on the accuracy with which the various measurements have been made by which their value has been determined; indeed certain errors have been pointed out in the determination of the units. The essential excellence of the metric system is derived from the multiplication and subdivision according to a uniform decimal notation. The multiples of the different units are indicated by prefixing Greek names of numbers to the name of the unit: the subdivisions by prefixing Latin names of numbers. These prefixes are, therefore, for decimal multiples, *deca-*, *hecto-*, (or *hect*), *kilo*, and *myrio*; and for decimal subdivisions they are *deci*, *centi*, and *mili*. Thus, for linear measurement we have the *metre;* its multiples, the *decametre* (ten metres), the *hectometre* (one hundred metres), the *kilometre* (one thousand metres), and the *myriometre* (ten thousand metres); and its subdivisions, the *decimetre* (one-tenth of a metre), the *centimetre* (one-hundredth of a metre), and the *millimetre* (one-thousandth of a metre). The importance of distinguishing between *deca* and *deci* will be recognized. In like manner with the litre, and the gramme. Two advantages follow from this plan. In the first place, the same prefixes are used in measures of length, surface, capacity, and weight. so that when known for one set they are known for all; and in the second place, the decimal system of multiplication and division banishes elaborate calculations in dealing with these measures.

Mg. The chemical symbol of Magnesium.

MICRO-PHOTOGRAPHY. A term sometimes used to express the reduction of negatives to a minute size. Not to be confounded with photo-micrography, *q.v.*

MILK (*A.S.*) The composition of this secretion varies considerably in different animals. It contains casein (a body having nearly the same composition as flesh), fats (butter) and milk sugar, together with some inorganic salts.

MILLIGRAMME. The one-thousandth part of a gramme. *See* METRIC SYSTEM.

MILLILITRE. The one-thousandth part of a litre. *See* METRIC SYSTEM.

MILLIMETRE. The one-thousandth part of a metre. *See* METRIC SYSTEM.

MINIM (*Lat.*) *See* WEIGHTS AND MEASURES.

MINUS. A sign, written thus (—), used in chemical formulæ, to signify abstraction from. *See* FORMULÆ.

MISCIBLE. Possible to be mingled.

MIXED BODY. That which is compounded of different elements, or principles; in which sense it stands distinguished from simple or elementary bodies, or those consisting of one principle only.

MIXED COLOURS. By mixed colours we understand the impression of colour which results from the coincident action of two or more colours on the same position of the retina. This new impression is single; it cannot be resolved into its components. Mixed colours may be produced by causing different parts of the spectrum to cover each other. They may also be produced by looking in an oblique direction through a vertical glass plate at a coloured surface, while at the same time the observer's side of the plate reflects towards his eye light of a different colour. The

method of the coloured disc affords another means of producing mixed colours.

Mn. The chemical symbol of Manganese.

Mo. The chemical symbol of Molybdenum.

MOLECULE (*Lat.*) The smallest quantity of a compound which can take part in a chemical reaction. Let us take, for example, a piece of sodium chloride, or table salt, and imagine that we have the power of subdividing it without limit. We have reason to think that, if we continue the process of subdivision long enough, we should at last reach a limit which could not be overpassed without altering the nature of the substance ; or, in other words, we should at last reach the smallest body capable of possessing the properties of salt. This is termed a *molecule*. If we still continue the subdivision, we separate the compound molecule of salt into its two components, sodium and chlorine, forming elementary *atoms*, which we cannot imagine to be capable of further subdivision.

MOLECULAR THEORY OF LIGHT. *See* IMAGE, LATENT.

MONOCHROMATIC LIGHT. *See* LIGHT, MONOCHROMATIC.

MONOCULAR VISION. Vision where one eye only is employed. A single eye sees most distinctly any point situated on its optical axis, and less distinctly other points also, towards which it is not directly looking, but are still within its circle of vision. It is able to judge of the *direction* of an object, but not by itself to estimate *distance*. It may, indeed, learn to estimate distance by such criteria as loss of colour, indistinctness of outline, decrease of magnitude, etc. ; but it is not infallible, even with such aids. *See* BINOCULAR VISION.

MORDANT, in dyeing, a substance which has a chemical affinity for colouring matter, and serves to fix colours. When that which has been dyed has little or no attraction to the matter on which the colour depends, so as either not to be capable of abstracting it from its solvent, or of retaining it with sufficient force to form a permanent dye, then some intermediate substance is used which is capable of uniting them. Such a substance is called a mordant.

MORPHIA PROCESS. *See* DRY PLATE PROCESSES.

MOUNTING PRINTS. For the purpose of mounting prints on cards the best material that can be used is starch, *q.v.* Glue, gum arabic, &c., are also used. The smaller sized prints especially had best be cut before toning. Place the prints, face downwards, in a heap, paste over the back of the top print, and place it in position on the card, care being taken that no hairs or lumps are allowed to get between the print and the card. When properly placed, rub down with the hand (a piece of paper being over the print), and more perfectly with a hard flat surface. For this nothing can be better than the bottom of a bottle. The position of the figure in the picture exercises considerable influence over the result. On this subject *See* CUTTING PRINTS. When the print is adjusted on the card and proper contact secured, gently bend back the card to slightly stretch the paper of the print, so that the contraction on drying is counteracted and "cockling" avoided. The mounted prints should be kept apart while drying so that any chance of endangering the permanence of the print from imperfect drying is avoided. In prints larger than cabinet cards, other and more important considerations arise. For carte-de-visite and cabinet pictures the ordinary mounts are accepted, and there is a fitness in the plain, conventional mount. In the larger sizes special treatment more adapted to the characteristics of the picture is required. In the first place a proportionately wider margin is absolutely necessary. A consideration of great importance, too often overlooked by photographers, is the incomparably superior results secured by placing the print under a passe-partout or cut-out mount. Theoretically, the difference between the white board on which the print is pasted, and the white passe-partout

placed over the print, may be imperceptible, but comparison will be quite convincing. Border lines are generally to be discommended ; for one picture improved by them, one hundred and more are ruined. It requires the greatest taste to discern when even a plain marginal rule is required ; if it is not necessary, the line is a defect. Better err on the side of simplicity. The "ornamental border" is odious. However good of design it may be, the thing is entirely out of keeping with the character of a photograph. Until, of all vile things, photography is impressed into the service of the valentine maker, "ornamental borders" should be kept far from it. For large prints many of the tints of grey are very suitable, especially that known as the "French Grey."

MUCILAGE. Solution of gum ; or any gummy substance.

MULLER (*Fr.*) Stone held in the hand, with which any powder is ground upon a horizontal stone.

MULTIPLYING CAMERA. A camera (fitted either with a single lens, or a series of objectives) which is constructed in such a way that the plate-holder will slide in a groove, exposing different portions of the plate to the illuminated object to obtain several pictures through one lens. Sometimes another movement is obtained by an arrangement for raising and lowering the slide in which the plate-holder runs.

MURIATE OF AMMONIUM. Ammonium chloride, *q.v.*

MURIATES (*Lat.*) Salts formed of muriatic acid with certain bases.

MURIATIC ACID. Hydrochloric acid, *q.v.*

MYRIOGRAMME. Ten thousand grammes. *See* METRIC SYSTEM.

MYRIOLITRE. Ten thousand litres. *See* METRIC SYSTEM.

MYRIOMETRE. Ten thousand metres. *See* METRIC SYSTEM.

N. The chemical symbol of Nitrogen.

Na. The chemical symbol of Sodium (Natrium).

NACREOUS (*Fr.*) Having the character of Nacre, or mother-of-pearl.

NATIVE METALS. *See* ORE.

NATURAL COLOURS, PHOTOGRAPHY IN. The reproduction of the colours of an object by the action of light is a problem which has occupied the attention of many experimenters ; yet we cannot claim any progress. The production of photographic images reproducing with some considerable exactness colours as well as form of the object pictured have been made, but no means were found to fix the image. The first experimenter of whom we have record, Prof. Seebeck, in 1810, obtained an imperfect image of the spectrum on a film of silver chloride. Herschel, in 1841, obtained similar results. Becquerel was, however, more successful with the use of silver plates subjected to the action of a galvanic battery to form a film of silver chloride. Niepce de St. Victor, following in the same direction, obtained a higher sensitiveness by coating the silver chloride film with dextrine and a solution of lead chloride, and was enabled to produce pictures by very extended exposure in the camera-obscura. All these images faded in the light. Other experimenters who have from time to time devoted their energies to the solution of the problem have not succeeded in obtaining permanence, nor have they developed any original means of producing the transient image.

NEGATIVE (*Lat.*) Generally applied to the image on glass, taken direct from the object, in which the lights and shades are reversed when viewed by transmitted light. From the negative may be obtained positives or prints, by placing sensitized paper in contact with it in a printing-frame. *See* PRINTING. Negatives may be made on paper. *See* CALOTYPE. By the dry plate, *q.v.* ; emulsion, *q.v.* ; and ordinary wet processes, the best results, however, are obtained. The attributes of a perfect negative are a homogeneous, structureless film, proper gradation of light and shade, the effect of skilful

manipulation, and good printing qualities. *See* COLLODION NEGATIVE PROCESS.

NEGATIVE BATH. The strength of the sensitizing bath is a question which still continues to excite discussion; it is a matter for individual experience to settle. That of from thirty-five to forty grains to the ounce of water has been found to give excellent results. *To make:* Dissolve in the bulk of water (distilled) required, nitrate of silver, until the argentometer registers, say, thirty-five grains to the ounce. In one-half the solution dissolve a few grains of iodide of potassium, filter quite clear, and pour in the uniodized half of the solution. This bath solution *may* be slightly acid (see *Acid Condition of Nitrate of Silver*); if it be not—*i.e.*, if blue litmus paper does *not* change to red—a few drops of nitric acid solution (one drop of acid to twelve of water) should be added. Ordinary cistern water may, on emergency, be used, but it is not advised, as so many impurities exist in it. When, however, ordinary water is employed, the bath solution should before being used be made alkaline by the addition of a few drops of ammonia solution, and, in a clear white bottle, be placed in the light for at least twenty-four hours, when a black deposit will be found at the bottom of the vessel containing the solution. Filter clear, and acidify, as before advised. With a large quantity of solution, ease and certainty in working are the better insured. Nothing is so trying as to be continually renovating the negative bath. Good, even results are almost impossible under the circumstances.

NEGATIVE BATH, ACIDITY OF. The acid condition of the bath is required when a bromo-iodized collodion is used, but it is advisable not to make the solution too acid. In practice it will be found that the use of acid may be largely increased without diminution of sensitiveness, and with good effect. Thin negatives full of detail and of exquisite gradation of tone may be produced from the acid bath. A very strongly-acidified bath has been advised, but its advantages were not generally recognized; probably because the conditions of use were not properly known or regarded. Before adding the nitric acid, on making up the bath solution, if slight acidity only is required, test its condition with blue litmus paper, and, if necessary, add with caution, as enjoined under the head of ADDITION OF ACID.

NEGATIVE BATH, ALKALINE. The negative bath in an alkaline state (there being, practically, no such thing as a "neutral" condition) has been worked with a considerable amount of success. The rule must, however, be strictly observed, of keeping a proper balance between the collodion and the bath. To work an alkaline bath the collodion must be decidedly acid. On any sign of fog, add to the collodion iodine, or old red collodion. To make the bath alkaline, add a few grains of carbonate of soda to the bath solution, sufficient to make the bath "milky," allow it to settle, and then filter clear. Should the bath become slow of working, and give thin half-tones, add more carbonate of soda, and filter as before. When thoroughly disordered, treat (*with the exception of addition of acid*) as suggested under the head of NEGATIVE BATH, TO RESTORE DISORDERED.

NEGATIVE BATH, FOG CAUSED BY. *See* FOG.

NEGATIVE BATH, "NEUTRAL." *See* NEGATIVE BATH, ALKALINE.

NEGATIVE BATH, ORGANIC MATTER IN. The contamination of the silver nitrate solution with organic matter interferes materially with the proper chemical action. Dust falling into the bath, dirty dippers, and dust on the backs of plates; the bath-holder not being cleaned when fresh solution is poured in, &c., &c., are the most common sources of mischief. The care of the photographer should be to keep the silver solution as pure as possible to ensure some degree of certainty of working, and, what is of extreme importance, to reduce the probable causes of failure. *See* NEGATIVE BATH, TO RESTORE.

NEGATIVE BATH, TO RESTORE DISORDERED. *Temporary Remedy:* Bath

solution out of order from the presence of organic matter may be again and again restored by adding permanganate of potash until it shows a violet colour. Place the solution in a clear white glass bottle, in the sun, until the solution, having thrown down a dark precipitate, clears. Filter, and acidify. *To Purify by Heat:* Dilute the solution to half its normal strength, and filter out the excess of iodide. Make the solution alkaline by the addition of a few drops of ammonia solution, place in an evaporating dish, on the stove, and boil until most of the water is evaporated off. Cool, filter out the dark precipitate, test the strength with the argentometer, and dilute to the original strength. Acidify as in making up new bath solution. *To Fuse.*—Dilute, and filter as before, evaporate to dryness, and fuse until the frothiness has subsided. Allow the solution to cool, and add sufficient nitric acid solution (one part of nitric acid in ten parts of water) to redissolve the silver, by means of heat. Evaporate to dryness, redissolve the silver nitrate in water; filter, and make up as in preparing the bath. *Precipitation of the Silver.*—Dilute, and filter. Place clean strips of copper in the solution, and allow it to rest for twenty-four hours. The silver will now be thrown down in a metallic state, and the copper left in solution. Decant the fluid, and, taking out any copper to be seen, wash the silver in changes of water until the blue colour, due to copper nitrate, is absent. Place the silver in a porcelain dish, and gradually add one drachm of pure nitric acid to every 150 grains of silver nitrate. Solution may be aided by means of heat. Boil down, add distilled water, and, little by little, silver oxide, until the greenish colour (due to the copper nitrate present) has entirely disappeared. Dilute the solution with distilled water until the required strength is reached, and filter clear. Another method is by the use of zinc in place of the copper. The particles of zinc falling with the silver may be dissolved by the addition of dilute sulphuric acid, or dilute hydrochloric acid. Boil, and wash well with boiling distilled water. Filter.

NEGATIVE, BROKEN. *See* BROKEN NEGATIVES.

NEGATIVE, DEVELOPING THE. *See* DEVELOPMENT.

NEGATIVE, EFFECT OF TIME ON. It may often be found that a negative from which were produced perfect prints will, after long keeping, grow intense, either from a change in the collodion film, or the varnish. Sometimes this may be remedied by dissolving off the varnish, and pouring over the film a very weak solution of potassium cyanide until the required reduction of intensity is attained, then washing and revarnishing.

NEGATIVE FOCUS. *See* FOCUS.

NEGATIVE, GLASS FOR. *See* GLASS PLATES FOR NEGATIVES.

NEGATIVE, "HARD," TO PRINT. *See* PRINTING INTENSE NEGATIVES.

NEGATIVE, INTENSIFYING THE. *See* INTENSIFICATION.

NEGATIVE, PAPER. *See* CALOTYPE.

NEGATIVE PROCESS. *See* COLLODION NEGATIVE PROCESS.

NEGATIVE, RETOUCHING THE. *See* RETOUCHING.

NEGATIVE, SHOWING THE. The desire to see the negative felt by some sitters is extremely awkward, as it requires considerable experience to judge of the picture which will result; an experience which many very accomplished operators never attain to the full. More often than not a fatal prejudice is engendered in the mind of the sitter, from the false impression formed on viewing the negative. Yet no hard-and-fast rules can be made by the photographer. If it becomes absolutely necessary to show a negative, the image may be made to appear like a positive by the application of a one-grain solution of chloride of gold. The change in appearance of the image may be watched at the back of the glass; when the required effect is produced, wash the plate.

NEGATIVE, STORING THE. The dampness of the atmosphere in rooms

where a fire is seldom lighted (as in the store room set apart for stored negatives) communicates moisture to the films, and thus speedily destroys the negatives. The negatives had best be placed upright in grooved shelves, the grooves in which they rest keeping them apart so that the air has free access to each plate. When room is required, the negatives may be wrapped in paper, and tied up in bundles, stout brown paper preserving them from the action of the atmosphere. This packing should be done in a warm room, that no dampness be inclosed.

NEGATIVE, THIN, TO PRINT. *See* PRINTING THIN NEGATIVES.

NEGATIVE TO A POSITIVE, TRANSFERRING THE. *See* TRANSFERRING THE NEGATIVE.

NEGATIVE, TO REDUCE INTENSITY OF. Over the unvarnished film pour the following solution:—Iodine one grain, potassium iodide two grains, water half an ounce, which changes the metallic silver of the film to the state of iodide. The intensity is now reduced by pouring over the film a weak solution of potassium cyanide. Where the negative has been varnished, the coating of varnish must first be removed by repeatedly pouring alcohol over it. An alcoholic solution of iodine is afterwards used. Wash thoroughly after these operations, as in fixing, *q.v.*

NEGATIVE, TREATMENT OF, BEFORE PRINTING. *See* PRINTING, TREATMENT OF NEGATIVES.

NEUTRALIZATION (*Lat.*) In Chemistry, the process by which an acid and an alkali are combined, so as to destroy each other's properties.

NITRATE BATH. A term sometimes used to express the sensitizing solutions of silver nitrate. *See* NEGATIVE and PRINTING BATH.

NITRATES—NITRITES. Compounds of nitric acid with a base. It will be noticed that nitric acid forms salts called nitrates, whilst nitrous acid gives rise to nitrites. This is an example of a general rule adopted in chemical nomenclature, that if the specific name of an acid or hydrogen salt ends in "ous," the names of the corresponding metallic salts end in "ite," whilst acids whose names end in "ic," form salts ending in "ate."

NITRE, OR SALTPETRE. *See* POTASSIUM NITRATE.

NITRIC ACID, OR HYDROGEN NITRATE. HNO_3. Nitric acid is obtained by heating nitre with sulphuric acid, or hydrogen sulphate, when nitric acid and hydrogen potassium sulphate are formed. Nitric acid is prepared on a small scale by placing about equal weights of nitre and sulphuric acid in a stoppered retort, which is gradually heated by a Bunsen's burner; the nitric acid formed distils over, and may be collected in a flask cooled with water. Nitric acid is a strongly fuming liquid, colourless when pure, but usually slightly yellow from the presence of lower oxides of nitrogen. It does not possess a constant boiling point, as it undergoes decomposition by boiling, and becomes weaker. It contains seventy-six per cent. of oxygen, with some of which it easily parts; hence it acts as a strong oxidizing agent. In nitric acid we have an example of a series of important compounds known as acids, *q.v.*, most of which are soluble in water; they possess an acid taste, and have the property of turning blue litmus paper red. For use in the negative bath, chemically pure nitric acid should be obtained.

NITROGEN. N. 14·01. Exists in the free state in the air, of which it constitutes four-fifths by bulk; it occurs combined in the bodies of plants and in various chemical compounds, such as nitre, whence the gas derives its name (generator of nitre). It is colourless, uncondensible, tasteless, inodorous, and neutral to vegetable colours. Dissolves in cold water to the extent of one and a half per cent. In the free state nitrogen exhibits no marked properties, though it enters into the composition of the strongest acids,

the most deadly poisons, the most brilliant colours, the most destructive explosives, appearing to give energy by its presence, and affording a strange contrast to its absence of character in the free state. Nitrogen is generally procured from the atmosphere by burning a piece of phosphorus under a bell jar standing over water. Many other means of obtaining nitrogen are used.

NITRO-HYDROCHLORIC ACID, OR AQUA REGIA. Certain metals, as gold and platinum, and many metallic compounds, as certain sulphides which do not dissolve in either nitric or hydrochloric acid separately, are readily soluble in a mixture of these acids, especially upon warming. This mixture has been termed aqua-regia because it dissolves the noble metals, and its solvent action depends upon the fact that it contains free chlorine, liberated by the oxidizing action of nitric acid upon the hydrogen of the hydrochloric acid. The metals combine directly with this free chlorine to form soluble chlorides, and the sulphides are decomposed by it. The nitric acid is reduced to nitrogen dioxide; this combines with a portion of the chlorine to form the compounds NOCl, and $NOCl_2$, which are liberated as yellowish gases, condensing to a dark yellow, very volatile liquid when they are led into a freezing mixture.

NOMENCLATURE, CHEMICAL. As there is a vast number of substances formed by the union of the elements amongst themselves, and of their compounds with one another, it has been found necessary to institute for them certain names according to their chemical composition. Whenever a non-metal and a metal, or two non-metals, unite chemically, the resulting compound receives the termination "ide," *e.g.*, oxide, bromide, sulphide, compounds of oxygen (O), bromine (Br), sulphur (S), with other elements, as oxide of copper or cupric oxide (Cu O), sodium bromide (Na Br), barium sulphide (Ba S). When a non-metal enters into combination with another element in several proportions, prefixes are used to distinguish them, as di, tri, tetra, deut, mon or mono, &c., *e.g.*, sulphuric dioxide ($S O_2$), sulphuric trioxide ($S O_3$), deut-oxide or dioxide of carbon (CO_2), monoxide of carbon (C O). The highest compound of the same name in a series often receives the prefix "per," *e.g.*, nitric peroxide ($N_2 O_4$). The prefix "sesqui" (one and a half) is used for compounds the atoms of whose elements are to one another in the proportion of 2 to 3; *e.g.*, iron sesquioxide (ferric oxide, $Fe_2 O$). The terminations "ie" and "ous" are frequently used, "ic" always denoting superiority to "ous" in point of number or quantity, *e.g.*, manganic oxide ($Mn O_2$), manganous oxide (Mn O). These two oxides might equally well be called dioxide and monoxide of manganese. The terms "hypo" and "hyper" are sometimes used to arrange a long series of compounds; *e.g.*, hypo-phosphorous acid ($H_3 PO_2$), a compound containing less than phosphorous acid ($H_3 PO_3$). If any compound formed by the union of two or more elements happens to have a sour taste, it is generally called an "acid," *e.g.*, hydric chloride (H Cl) is called hydrochloric acid and muriatic acid. Acid bodies generally contain hydrogen, which they are capable of exchanging for some other element; when dissolved in water they taste sour, redden blue litmus paper, and change brown turmeric paper to yellow. Bodies forming compounds similar to the acids are called non-basylous radicals. The term base or basylous radical is given to a large number of compounds possessing generally the opposite qualities to an acid; *e.g.*, most of the oxides of the metals are bases, because they can give their basylous or metallic element to an acid in exchange for hydrogen. The chemical term "salt," originally given to sodium chloride, or common salt (Na Cl), is now applied

to a mass of chemical compounds, many of which have no taste at all. A compound of any non-metal with a metal is a salt of the metal; and when spoken of collectively, the compounds of a metal with the non-metals are often called salts of that metal, *e.g.*, salts of silver, salts of iron. The salts of one class are frequently spoken of collectively, as oxides, sulphides, oxygen salts, sulphur salts.

NOMENCLATURE OF COLOURS. There is no very accurate system of nomenclature of colours in general use. The most accurate plan for scientific purposes is to refer to a portion of the solar spectrum by giving the distance between any two of the lines. In ordinary language, red, yellow, and blue are called primary colours, combinations of these are secondary colours, red and yellow give orange; yellow and blue give green; blue and red give purple. Combinations of secondary colours give tertiary colours; thus purple and orange give russet; orange and green give citrine; and green and purple give olive. Most colours, however, have some arbitrary name, such as magenta, phosphine, humbold; or they are named after natural substances, as fuschine, emerald green, canary yellow, &c.

NON-REVERSING SLIDE. A plate holder in which the plate may be exposed with the glass side to the lens; so that the image is not laterally reversed. The collodionized plate being placed in the holder, film upwards, a plain glass with a piece of glass cemented to each corner is placed upon it, the spring pressing on the plain glass.

NUMBERING THE PRINTS. *See* PRINTS, RECORD OF.

O. The chemical symbol of Oxygen.

OBERNETTER PROCESS. *See* MECHANICAL PROCESSES.

OBJECT GLASS. The lens or combination of lenses which in a telescope or microscope forms the image of an object in its focus, which image is afterwards viewed by an eye-piece.

OBJECTIVE. A term sometimes applied to lenses.

OBLIQUE. (*Lat.*) Deviating from a perpendicular line or direction; as an oblique angle, that which is not a right one.

OCHRE (*Gr.*) A name applied to several metallic oxides in a native pulverulent condition, when of a brownish yellow colour. It is, however, chiefly applied to hydrated ferrous oxide when fit for use as a pigment, and is called red ochre, brown ochre, or yellow ochre, according to colour.

OCTAGON (*Gr.*) Enclosure with eight equal sides.

OCTOHEDRON (*Gr.*) Anything having eight plane surfaces, as some crystals.

OIL (*A.S.* and *Lat.*) A general term applied to an immense number of bodies which have certain physical properties in common. They may be divided into two great classes, fixed oils, and volatile or essential oils. They are almost all liquid at the ordinary temperature, are more or less viscid, and insoluble in water. Inflammable either at the ordinary temperature, or when heated. The fixed oils are not volatile without decomposition. Some of them oxidise when exposed to the air, and dry to a caoutchouc-like substance, whilst others are non-drying. The essential oils are of a peculiar pungent odour, distil without decomposition, and are very inflammable.

OIL, ESSENTIAL. *See* ESSENTIAL OILS.

OIL OF DIPPEL. *See* ANIMAL OIL OF DIPPEL.

OIL PAINTINGS, TO COPY. *See* COPYING.

OLD NEGATIVE FILMS, TO REMOVE. *See* ALBUMENIZING GLASS PLATES.

OPACITY (*Fr.* and *Lat.*) That quality of a substance which causes it to be impervious to light. The antithesis to transparency.

OPALOTYPE. Pictures on opal or porcelain glass give very pleasing results. A ready method is by the collodio-chloride process. Mix three stock solutions:—(No. 1.) Silver nitrate, 1 drachm; distilled water, 1 drachm. (No. 2.) Strontium chloride, 64 grains; alcohol, 2 ounces. (No. 3.) Citric acid, 64 grains; alcohol, 2 ounces. To every two ounces of plain collodion add thirty drops of solution No. 1, previously mixed with one drachm of alcohol; then one drachm of No. 2 gradually, and shaking well; lastly, half a drachm of No. 3. This may be used in a quarter of an hour. Clean the plate thoroughly, and edge with albumen; coat with the collodio-chloride, and dry by heat. Cool and print under a negative. Tone in a weak bath, or after the prints of the day have been toned. The toning should not be continued beyond warm brown or purple, as the tone is not reduced in the fixing bath of sodium hyposulphite. *See* PORCELAIN PICTURE.

"OPENING." The diameter of the lens.

OPERATOR (*Lat.*) A term generally applied to the person who produces the negative.

OPTICAL CENTRE: SECONDARY AXIS. In every lens there is a point called the optical centre, which is situated in the axis, and which has the property that any luminous ray passing through it experiences no angular deviation, that is, that the emergent ray is parallel to the incident ray.

OPTICS (*Gr.*) The science which treats of the phenomena of light with respect to vision.

ORE (*A.S.*) Natural compounds of metals with the non-metallic elements, chiefly oxygen and sulphur, are called ores of the metals. When the metals occur by themselves, or alloyed with other metals, they are said to be native. Sometimes the mineral or other valuable substance found is called the ore; thus we hear of diamond ore, sulphur ore, &c.; but in such cases the term matrix, *q.v.*, would be more appropriate.

ORGANIC MATTER. A term somewhat loosely used in photography to denote varieties of non-volatile animal or vegetable substances of unknown composition which influence the action of the sensitizing and developing solutions. The general effect of organic matter in combination with the reduced silver of the photographic image is to increase intensity. In excess its influence is to destroy the sensitizing powers of the silver solution. For means of eliminating *see* NEGATIVE, and PRINTING BATH, TO RESTORE.

ORPIMENT. Arsenic trisulphide, $As_2 S_3$. Sometimes known as the yellow sulphide of arsenic, a fine lemon-coloured powder, used as a pigment, and as a dye.

ORTHOSCOPIC LENS. The title of a lens.

OSMOSE, or OSMOSIS (*Gr.*) A word used to express the phenomena attending the passage of liquids through a porous septum. It includes endosmose and exosmose, terms now seldom used. When two saline solutions, differing in strength and composition, are separated by a porous septum of bladder, parchment paper, &c., they mutually pass through and mix with each other; but they pass with unequal rapidity, so that after a time the height of the liquid on each side is different. By placing pure water on one side of the septum, and the saline solution in the other, the rate of osmose can be ascertained for any particular salt. *See* DIALYSIS, also ENDOSMOSE, and EXOSMOSE.

OUNCE (*Fr.* and *Lat.*) The name of a weight, of different value in different denominations of weight and measure—*i.e*, in avoirdupois weight, the sixteenth part of a pound; in troy weight, the eighth part; in apothecaries weight, the twelfth part; and in liquid measure, the twentieth part of a pint *See* WEIGHTS AND MEASURES.

OUTDOOR PHOTOGRAPHY. *See* LANDSCAPE.

OVALBUMEN. Albumen extracted from eggs, in distinction from that obtained from the blood.

OVAL, PRINTING IN. *See* PRINTING OVALS.

OVER-EXPOSURE, EFFECT OF. Over-exposure causes such rapid reduction of the silver, directly the developer is poured over the plate, that control is lost over the action, and before the developer may be washed from the plate a complete veiling of the picture has resulted. The same action takes place when a developer deficient in acid is used.

OXALATE DEVELOPER. To a saturated solution of ferrous sulphate, add sufficient of a saturated solution of oxalic acid to cause all the iron to be precipitated as ferrous oxalate. This is washed in five or six changes of water: on each addition it should be well stirred, and afterwards decanted. Next prepare a saturated solution of neutral potassium oxalate, by adding to a saturated solution of oxalic acid a saturated solution of caustic potash, until red litmus paper is faintly blue tinted; then add a crystal of oxalic acid. Just sufficient ferrous oxalate is added to the warm potassium oxalate as to leave a slight portion of the ferrous compound undissolved. When cold, it is filtered. As a restrainer, the addition of a grain or two of potassium bromide may be necessary.

OXALIC ACID. $C\ H_2\ O_4$. Oxalic acid is met with in the juice of many plants in the form of potassium or calcium salts It is formed in a great variety of ways, chiefly by the oxidation of different organic bodies. The best way of preparing pure oxalic acid on a small scale is by acting on sugar with nitric acid; but it may in larger quantities be manufactured by the action of caustic potash on sawdust. Crude potassium oxalate is thus formed, and from this a pure oxalic acid is obtained by precipitating the insoluble calcium oxalate, and decomposing this by sulphuric acid. May also be prepared by the direct oxidation of glycolic acid. Oxalic acid crystallizes in prisms which possess the composition $C_2H_2O_4 + 2H_2O$. These crystals lose their water of crystallization at 100°, or in vacuum over sulphuric acid. Decomposes when heated over 160°. Alkaline oxalates are soluble, but most others are insoluble, or difficultly soluble. With many metallic solutions oxalic acid acts as a reducing agent; under its influence gold and platinum are reduced to the metallic state, and per-salts of mercury, iron, &c., are reduced to pro-salts.

OXGALL. Useful in colouring prints on albumenized paper when the surface refuses to take the colour.

OXIDATION. Condition resulting from the action of oxygen. As many of the chemicals in use in photography are prone to oxidation when exposed to the air, and lose their properties either wholly or in part, it is advisable as much as possible to keep them apart from the influence by preserving them in close-stoppered bottles.

OXIDE, OR OXYDE. A substance combined with oxygen, without being in the state of an acid. One of the first and most ordinary changes to which metallic substances are subject is their combination with oxygen. The process is called oxidation, and the new substance an oxide.

OXY-CALCIUM LIGHT. *See* ARTIFICIAL LIGHT.

OXYGEN. O. 15·96. A colourless, invisible gas, possessing neither taste nor smell. Exists in the free state in the atmosphere, of which it constitutes about one-fifth by bulk, whilst in combination with the other elements it forms nearly half the weight of the solid earth, and eight-ninths by weight of water. Oxygen gas can be prepared from the air, but it is more easily obtained from many compounds which contain it in large quantities; as by heating potassium chlorate, which yields 39·2 of its weight of this gas.

OXY-HYDROGEN LIGHT. *See* ARTIFICIAL LIGHT.

OXYMEL, used as a preservative in the Dry Plate Process, may be prepared

by boiling one ounce and a half of honey in two ounces of distilled water, for a short time, and after it has cooled and been filtered, adding one drachm of acetic acid.

OYSTER-SHELL MARKINGS on the plate are caused by unequal drying, from keeping the plate standing before exposure.

OZONE (*Gr.*) Pure oxygen undergoes a remarkable modification when a series of electric discharges is passed through the gas; it thus attains more active properties. It possesses a peculiar smell, and is able to set free iodine from potassium iodide, as well as to effect oxidations which common oxygen is unable to bring about. Ozone is oxygen in a condensed state. The amount of condensation which common oxygen undergoes, as well as the quantity of ozone formed, being known, the density of ozone can be ascertained. It is found that three volumes of oxygen condense to form two volumes of ozone. Ozone exists in the atmosphere, and its presence is recognised by the blue colour it imparts to paper impregnated with starch paste and iodide of potassium solution; still it is to be remembered that there are other oxidizing gases which produce the same effect.

P. The chemical symbol of Phosphorus.

PAINTINGS, TO COPY. *See* COPYING.

PALLADIUM. Pd 106·2. A metallic element belonging to the platinum group. It melts at a lower temperature than platinum; oxidizes superficially when heated to below redness in the air, but is reduced again at a higher temperature. Palladium chloride has been recommended for toning transparencies and enamels, and for intensifying.

PANEL PORTRAIT. A style of portraiture introduced in America, adapted to standing figures. The size of the print is four inches by eight inches. In the very pretty specimen illustrating an issue of "*The Photographic Rays of Light*," the size of the picture, printed in an arched-top form, is two and a half inches by six and three-quarters, with a delicately tinted margin surrounding it. The size is particulary well adapted to the requirements of the standing figure, and would without doubt meet with general approval if more prominently brought before the public.

PANORAMIC PHOTOGRAPHY. By means of a rotating camera turning on a pivot on a large polished table, a wide angle of view, limited only by the length of the sensitized plate, may be obtained. The rays of light pass through a slit about a quarter of an inch wide, and where the foreground falls, a little wider to secure longer exposure for that portion of the view. The motion of the dark slide containing the sensitized plate, and the motion of the camera on its axis, are managed by a simple arrangement of clockwork. All parts of the picture will be equally sharp, vertical lines will not be bent out of the perpendicular, but the perspective of the picture will be panoramic, and not plane, so that the horizontal lines of objects vanish in curved, and not in straight lines.

PANTOSCOPIC CAMERA. The style of a rotating camera for panoramic views, *q.v.*

PAPER. Generally the paper manufactured and sold for purposes of photographic printing is sufficiently good in quality for the production of the most excellent work; though, by the careless and inexperienced printer, it is made the excuse for his failures. Certain defects are, however, communicated in the process of albumenizing, on the subject of which the reader is referred to the writer's work on "Photographic Printing," as it is beyond the scope of the present work. *See also* ALBUMENIZED PAPER, DEFECTS IN.

PAPER, ALBUMENIZED. *See* ALBUMENIZED PAPER.

PAPER, COLLODIO-CHLORIDE. For the method of preparing collodio-

chloride, *see* OPALOTYPE. A sizing of arrowroot or gum tragacanth is applied to the paper to render it non-absorbent. The collodio-chloride is poured over the paper as over a glass plate. The paper is then dried, and printed under a negative. Tone and fix in the ordinary printing, sensitizing, and fixing baths.

PAPER, ECONOMY IN USE. With care, pieces of albumenized paper may be cut into print sizes with very little waste. On one side of a straight-edge mark off so many lengths of the card picture, on the other side so many breadths, in each case allowing a necessary margin. By laying this straight-edge on a piece of paper, of any size, an idea may be formed in a moment how best it may be cut. In the same way cabinet and other sizes may be estimated. Tearing paper is very wasteful.

PAPER, FAILURES DUE TO. *See* ALBUMENIZED PAPER, DEFECTS IN.

PAPER, IRON SPOTS IN. Tiny spots of iron are sometimes present in the body of the paper, probably communicated from the machinery, and these specks cause rusty spots in the print. More often, however, the rust is communicated to the surface of the paper in the albumenizing or drying rooms. *See* ALBUMENIZED PAPER, DEFECTS IN.

PAPER NEGATIVES *See* CALOTYPE.

PAPER, PLAIN. *See* PLAIN PAPER.

PAPYROGRAPHY. *See* MECHANICAL PROCESSES.

PARABOLIC LENS. A lens ground to a parabolic surface is free from spherical aberration, but the difficulties of grinding this are so great that these lenses are not made. Spherical aberration may be overcome by other means. *See* ABERRATION, SPHERICAL.

PARALLEL (*Gr.*) Line continuing its course, and still remaining at the same distance from another line.

PARCHMENT PAPER. When unsized paper is plunged into a cold mixture of two parts of conc. sulphuric acid, and one part of water, and after a few minutes removed and well washed in abundance of pure water, it will be found that whilst its chemical composition remains the same, its physical properties are entirely altered. It is converted into a tough membranous body resembling parchment. Its strength is enormously increased, so that a strip which originally would not support more than three or four pounds when dry, and scarcely an ounce when wet, will now carry thirty pounds either wet or dry. It is invaluable to the photographer as forming the most efficient septum in the process of dialysis, *q.v.*

PARIS, PLASTER OF. *See* PLASTER OF PARIS.

PASTE. Mix the flour in a little cold water, thin down with water, and boil, stirring the mixture well all the time. Strain through muslin. Alum is sometimes added to give keeping qualities to paste. It is inferior to starch, *q.v.*, for mounting pictures.

PASTE, ENCAUSTIC. *See* ENCAUSTIC PASTE.

Pb. The chemical symbol of Lead. (Plumbum).

Pd. The chemical symbol of Palladium.

PEARLASH. *See* POTASSIUM CARBONATE.

PELLICLE (*Lat.*) Thin skin; film. A term applied to an emulsion when the solvents have been evaporated therefrom.

PENCIL (*Lat.*) Small brush of hair; also a slender bar of blacklead encased in wood; used in the process of retouching, *q.v.*

PENCIL OF RAYS. If the eye look towards a luminous point which forms a centre from which waves of light proceed in all directions, a cone or bundle or pencil of rays strikes the eye. If the luminous point be near the eye, the pencil of rays is divergent. On the other hand, the light which strikes the eye from a star or body at a very great distance may be regarded as a pencil of parallel rays. We may also have a pencil whose section lessens as it pro-

ceeds, in which case it is called a convergent pencil.

PENNYWEIGHT. Troy weight containing twenty-four grains. *See* WEIGHTS AND MEASURES.

PERMANENCE OF PRINTS. *See* FADING.

PERMANGANATE OF POTASH. *See* POTASSIUM PERMANGANATE.

PERSPECTIVE (*Lat.*) That branch of optics which teaches the art of representing objects on a plane surface in the manner they appear under the peculiarities incident to distance and height. The photographer should be conversant with the laws of perspective, so that he may be enabled to secure a view true as possible by the lens.

PHENIX PLATE. The title of an extensively used ferrotype plate manufactured by the Scovill Company, of New York.

PHOSPHORESCENT PICTURES. *See* EPHEMERAL PHOTOGRAPHS.

PHOSPHORIC ACID, $P_2 O_5$, is produced when phosphorus burns in air or oxygen. It is a very light amorphous substance, extremely deliquescent in moist air, and hisses like red-hot iron when thrown into water. It is a powerful acid, and has different properties according to the number of atoms of water with which it unites.

PHOSPHORUS (*Gr.*) P. 30·96. Prepared from powdered bone ash, by mixing it with two-thirds of its weight of sulphuric acid and fifteen to twenty parts of water. The sulphuric acid decomposes the bone ash, forming calcium sulphate or gypsum, which separates out as a white insoluble powder, whilst the greater part of the phosphorus in the bones comes into solution in combination with calcium, oxygen, and hydrogen, forming calcium hydrogen phosphate, commonly known as superphosphate of lime. The liquid is drawn off clear, evaporated down to a syrup, and then mixed with powdered charcoal, dried and heated to redness in an earthenware retort, the neck of which dips under water. It may be purified by being again distilled, or passed when melted under hot water through leather. Phosphorus is an exceedingly inflammable and oxidizable substance. It is a slightly yellow, semi-transparent solid, resembling wax in appearance and consistency, but at low temperatures it becomes brittle. Specific gravity 1·83; melts at 44°, forming a transparent liquid, boils at 290°, giving rise to a colourless gas. In the air it gives off white fumes, emitting a pale phosphorescent light in the dark; it is then undergoing a slow combustion.

PHOTO-ETCHING. *See* MECHANICAL PROCESSES.

PHOTO-GALVANOGRAPHY. *See* MECHANICAL PROCESSES.

PHOTOGEN. A lantern adapted for burning pyrotechnic compounds for the production of artificial light in the glass-house.

PHOTOGENIC DRAWING. A synonym of photography.

PHOTO-GLYPTY. *See* MECHANICAL PROCESSES.

PHOTOGRAPHY (*Gr.*) The art of obtaining representations of objects, and fixing the images on substances sensitive to light. Photographs are divided into positive and negative. A negative, that in which the lights and shades, viewed by transmitted light, are reversed; and a positive, one in which they are exhibited as in nature. Under the distinctive headings of the various processes will be found an outline of the manipulations.

PHOTOGRAPHY IN NATURAL COLOURS. *See* NATURAL COLOURS.

PHOTOGRAPHY, INSTANTANEOUS. *See* INSTANTANEOUS PHOTOGRAPHY.

PHOTO-GRAVURE. *See* MECHANICAL PROCESSES.

PHOTO-LITHOGRAPHY. *See* MECHANICAL PROCESSES.

PHOTOMETER. *See* ACTINOGRAPH.

PHOTO-MICROGRAPHY. A term used to denote the art of producing enlarged photographs of microscopic objects.

PHOTO-TYPY. *See* MECHANICAL PROCESSES.

PICTURES FOR THE MAGIC LANTERN. *See* TRANSPARENT POSITIVES.

PICTURESQUE. Expressing that peculiar kind of beauty which is agreeable in a picture, whether natural or fictitious; striking the mind with great power or pleasure in representing objects of vision.

PIGMENT (*Lat.*) Colouring matter.

PIGMENT COLOURS. A distinction must be made between the result of mixtures of pigment colours and spectral colours, *q.v.* Thus a mixture of pigment yellow and pigment blue produces green, not white, as is the case when the blue and yellow of the spectrum are mixed. The reason of this is that in the mixture of pigment we have a case of subtraction of colours, and not of addition. For in the mixture, the pigment blue absorbs almost entirely the yellow and red light; and the pigment yellow absorbs the blue and violet light, so that only the green remains.

PIGMENT PRINTING. *See* AUTOTYPE PROCESS.

"PINHOLES," minute, transparent holes over the entire surface of the film, showing after the fixing, are generally to be attributed to a sensitizing bath overcharged with iodide. On withdrawing it from the bath, the plate, when viewed by transmitted light, will have the appearance of being covered with fine sand; these particles dissolve in the fixing bath, and leave the tiny holes known as "pinholes." Dust settling on the collodionized or sensitized plate sometimes gives rise to the same defect, but in this case the pinholes are neither so numerous nor so regular in size.

PINS, for use in hanging papers during drying, should be of silver, or coated with varnish. For hanging up sensitized paper, the most serviceable article is the ordinary wooden clip, which is not only more secure than a pin, but is more readily adjusted, and not liable to get out of order or be mislaid.

PINT. Twenty ounces liquid measure. *ee* WEIGHTS AND MEASURES.

PLAIN COLLODION. Pyroxyline dissolved in alcohol and ether. *See* COLLODION.

PLAIN PAPER. Paper which has not been albumenized; in the use of which a special treatment is requisite. *See* PRINTING ON PLAIN PAPER.

PLANE (*Lat.*) In geometry, a plain surface, or one that lies evenly between its boundary lines; and as a right line is the shortest extension from one point to another, a plane surface is the shortest extension from one line to another.

PLANO-CONCAVE. Plane on one side, and concave on the other. *See* LENS.

PLANO-CONVEX. On the one side plane, and on the other convex. *See* LENS.

PLANTS, JUICES OF. *See* JUICE OF PLANTS.

PLANTS, PHOTOGRAPHING. *See* FLOWERS, PHOTOGRAPHING.

PLASTER OF PARIS. Calcium sulphate, $Ca\,So_4$, occurs in nature as a mineral termed Anhydrite, and combined with $2H_2O$ as selenite, gypsum, or alabaster. It is soluble in four hundred parts of water, and is a common impurity in spring water. Gypsum when moderately heated loses its water, and is then called Plaster of Paris; this, when moistened, takes up two atoms of water again, and sets to a solid mass, and is therefore used for making casts and moulds.

PLASTIC. Easily made to take form.

PLATE. Generally applied in photography to the sheet of glass on which the sensitized film is held in the manipulations of making the negative. *See* GLASS PLATES FOR NEGATIVES. Also in the ordinary sense to metal plates engraved in any of the Photo-mechanical processes. *See* MECHANICAL PROCESSES.

PLATE, ALBUMENIZING THE. *See* ALBUMENIZING GLASS PLATES.

PLATE, CLEANING THE. *See* GLASS PLATES, CLEANING.

PLATE; COATING WITH COLLODION.

See COLLODION, COATING THE PLATE WITH.

PLATE, DRY. *See* DRY PLATE and EMULSION PROCESSES.

PLATE GLASS. *See* GLASS.

PLATE HOLDER. The holder or carrier in which the sensitized plate is held in the camera during the exposure should be perfectly light-tight, and at all times kept scrupulously clean. The position of the plate should correspond exactly with that occupied by the ground glass, or the focus will be faulty. The best form of holder is that with glass corners on which the plate may rest; the silver wire corners are neither so durable nor so exact. The plate should not come into contact with the wood. After each exposure it is well to wipe out the holder with a damp sponge, and after the work of each day to more thoroughly wash, and dry. Silver must not be allowed to accumulate at the bottom of the holder. At intervals the holder should be washed in hot water, dried, and coated with a thin varnish of shellac dissolved in alcohol. By these simple means the holder will outlast several not so looked after, and, what is almost of greater importance, be always reliable.

PLATE HOLDER, DEFECTS DUE TO. (1.) *Opaque streaks* from a corner of the plate, seen after development, probably denote the ingress of light into the holder; it may be, however, due to dirty fingers. (2.) *Irregular transparent marks*, "pinholes," are caused by dust set flying in opening and shutting the dark slide, or by any jar of the holder in setting it down, or placing in or withdrawing from the camera. With the precautions suggested under PLATE HOLDER these marks would be rare. (3.) *Short transparent marks* are from fibre settling on the film. (4.) *Reduced silver* at the corners of the plate, giving rise to opaque marks, may be due to impurities in the silver wires at the corners. (5.) *Opaque line*, along the edge of the plate nearest the opening for the slide, is caused by leakage of light there—a common defect where the dark slide withdraws entirely.

PLATE, WASHED DRY. *See* DRY PLATE and EMULSION PROCESSES.

PLATE, WASHED, in the Wet Process. *See* WASHED PLATE.

PLATINOTYPE. A sheet of plain paper is coated with a mixture, in equal quantities, of the following solutions:—Ferric oxalate, 130 grains, in 1 ounce of water; chloroplatinate of potassium, 30 grains, plumbic chloride, 3 grains, in 1 ounce of water. This is spread over the paper by means of a glass rod covered with flannel. When the paper has drained, it is dried before the fire. The exposure is about a third that required for an ordinary print; its duration may be, however, decided by the appearance of the print, a faint image showing. Development is effected by floating the print for a few seconds on a warm solution of potassic oxalate, 120 grains; chloroplatinate of potassium, 7 grains; water, 1 ounce.

PLATINUM, Pt. 196·7. A comparatively rare metal, which always occurs in the native state, and generally alloyed with five other metals, viz., palladium, rhodium, iridium, osmium, and ruthenium. This alloy occurs in small grains in detritus and gravel in Siberia and Brazil. The metal may be prepared by dissolving the ore in *aqua regia*, and precipitating the platinum (together with several of the accompanying metals) with sal-ammoniac, as the insoluble double chloride of ammonium and platinum. This precipitate, on heating, yields metallic platinum in a finely divided or spongy state. When hot, this may be pressed or hammered into a coherent metallic condition. Platinum possesses a bright white colour, and does not tarnish in the air. It is extremely infusible, and can only be melted by the heat of the oxy-hydrogen blowpipe. Ordinary acids do not act upon it, but *aqua regia* dissolves it; hence platinum vessels are much used in the laboratory.

PLATINUM DICHLORIDE, $PtCl_2$. A

green insoluble powder, obtained by heating the higher chloride to 200°.

PLATINUM TETRACHLORIDE, Pt. Cl_4, is obtained as a yellowish red solution by dissolving the metal in *aqua regia*. On evaporation, crystals of a compound of platinum tetrachloride with hydrochloric acid separate out. Platinum tetrachloride combines with many alkaline chlorides to form double salts; these compounds, with potassium, ammonium, &c., are insoluble in water, and are isomorphous, crystallizing in cubes; whilst the sodium salt is soluble, and crystallizes in large prisms.

PLUMBAGO, OR GRAPHITE. *See* CARBON.

PLUMBAGO BACKGROUNDS. The sitter should be taken against a dark background. Dry the negative after fixing, and then wet it again. Pour over it a solution of dextrine, one drachm; ammonia bichromate, half drachm; sugar-candy, one drachm; water, five ounces. Filter before using. When the coating of dextrine has dried (by the aid of heat), the background negative is placed in contact. Expose about twenty-five minutes in a good light. Remove the background negative, and apply plumbago with a fine camel-hair brush all round the figure, until sufficient density is secured. Dust off the superfluous plumbago, and varnish. If any difficulty be found in getting proper density, breathing on the part will be of service.

PLUS, in formulæ, a character written thus, +, used as a sign of addition. *See* FORMULÆ.

POINT (*Fr.* and *Lat.*) In Geometry, that which has neither part nor magnitude, but only position and relation; invisible part of space.

POLARIZATION OF LIGHT. *See* LIGHT.

PORCELAIN CLAY. *See* KAOLIN.

PORCELAIN PICTURES may be made with the collodio-chloride process. *See* OPALOTYPE. The following formulæ are recommended for obtaining, with uniform success, superior porcelain pictures, possessing strength, beauty of tone, and permanency. *Albumenizing the Plate.*—Dissolve three grains strontium chloride in four drachms of water, and add the white of one egg, beaten to a stiff froth; let it settle, and filter through sponge. Clean the porcelain plate by placing it in acid for several hours; wash thoroughly, and, when dry, wipe with flannel dipped in alcohol, and rub dry with clean flannel. Remove particles of dust with camel-hair brush, and pour on the albumen cold, drying it by heat. Plates thus prepared can be kept any length of time, and are ready for use at any moment. *Sensitizing the Plate.*—Dissolve one ounce of silver in twelve drachms of water, by grinding the silver in a glass mortar and adding the water. Take of this four drachms into a clean graduated measure or wide-mouthed bottle, and add thereto, by drops, liquor ammoniæ, which will brown the solution; add, by drops, pure nitric acid until it is clear, then add the twelve drachms of silver thus treated to twelve ounces 94 per cent. alcohol, stirring while adding; filter, and it is ready for use. When wanted for use, filter, and pour into a clean sensitizing dish. Warm the plate, and dip it into the bath, allowing it to remain therein two minutes for polished plates, and three minutes for those with a ground surface; remove from the bath, and let it drain; then flow with 95 per cent. alcohol, pouring on the corner sufficient to cover the plate. A repetition of this upon a different corner of the plate may be required before it presents an even surface. When the plate is drained, and dried by heat, it is fumed from five to ten minutes. Should a vapour appear after fuming, gently heat the plate, and it will disappear. Print a shade deeper than for prints on paper. *Toning the Print.*—When printed, place the plate in acid water, in proportion of half an ounce of acetic acid to sixteen ounces of water; let it remain therein for several minutes, or until the picture is changed to a uniform red tint, then wash in several changes of water, or

under a tap, and tone in a solution prepared the same as for paper prints. Examine the progress of the toning by transmitted light, care being taken not to over-tone the print. *Fixing*.—When toned, wash, and place in the fixing solution: sodium hyposulphite, one ounce; water, ten ounces; fix from five to ten minutes, then wash under a running stream from ten to fifteen minutes; dry with gentle heat. For plain prints, or those to be tinted, plates with a polished surface are used; for finish in colours, plates with a ground surface produce the best results. Photographic prints upon watch-dials, &c., can be made in the same manner.

POROSITY (*Lat.*) A term used to describe the fact that, in all matter with which we are acquainted, the constituent particles are not uniformly and completely contiguous to one another, but are separated by intervening spaces or pores. The pores of bodies may be filled by other substances whose particles are smaller than the pores. Thus in filtration we separate from liquids various solid particles which are too large to enter or pass through the pores of the filtering material, such as paper, charcoal, &c., while the liquid will enter and pass through them. When the pores are not filled with other substances they are usually filled with air. This may be seen when dissolving sugar, the air rising in bubbles to the surface of the liquid. Many metals become more dense by hammering, and all metals decrease in volume as they are rendered colder, so that the particles cannot be in complete contact.

PORTRAIT (*Fr.*) Picture drawn after the life.

PORTRAIT CAMERA. The camera for the studio should be very ready of adjustment, easily moved on its stand about the gallery to get the best point of view, and exact of focus with easy movement to it. The camera should be fitted with a bellows body, and the swing back must be considered indispensable.

PORTRAIT CAMERA, DEFECTS DUE TO. 1. *Double outlines, or "blurring,"* from movement of the camera during exposure of the plate; cause: want of steadiness. 2. *Double pictures* are sometimes caused by a minute hole in front of the camera. 3. *Want of sharpness*, from the ground glass not being on the same plane as the sensitized plate. *See* ACTINIC FOCUS OF LENS.

PORTRAIT, COMPOSITE. A curious and interesting application of portraiture made by Mr. Francis Galton, F.R.S., who has striven to produce ethnological types by the combination of several pictures. Combined portraits, printed from negatives of different members of a family, the pictures being of the same size, and embracing the same view of the face, were found to retain the characteristic features and expressions, and lose the individual, and thus form a typical portrait of the family.

PORTRAIT LENS. The rapidity of working of a portrait lens depends on its diameter, and its focal length regulates the size of the picture. In choosing a portrait lens, too much importance must not be laid on its rapidity, as speed is more or less secured at the expense of other valuable qualities, as depth, &c.

PORTRAIT ROOM. *See* GLASS HOUSE.

POSE (*Fr.*) Attitude which the character represented is considered to have taken naturally, or to have settled in.

POSING. The laws of art are not to be taught in a single article. In this place it will be possible to suggest only the barest outlines. The first consideration is as to the correctness of the outside lines of the composition, whether of a head and bust of a single sitter, or of a number of figures in a group. Having arranged the outline, particular attention must be given to each of the interior lines, correcting, supplying, and compensating where necessary. The quarter or half-length pictures are now generally preferred to the full-length. For these we must secure the best view of the

face, and avoid (in the majority of cases) posing the head and body in the same direction. Small eyes should be directed slightly upwards, staring eyes a little downwards, inset eyes full view. Never turn the eyes in a contrary direction to that of the head; generally they should be a shade in advance of the direction of the head. Large and ugly mouths should be taken in profile, or partially hidden by a fan, flower, &c. The hands should not be introduced if it can be avoided; if shown, turn the edge, not the back, to the camera. The eye of the artist should be trained, by a thorough knowledge of art, to recognise what is likely to produce an artistic picture. Children must, to a great extent, be taken as they present themselves to the artist, yet by sympathy, patience, and art, much may be done with them.

POSING CHAIR. *See* ACCESSORIES.

POSITION. In the arts, the appropriate placing of the model or object to be copied.

POSITIVE. The term ordinarily applied to photographs in which the lights and darks are rendered as they are seen in nature. Made directly from the object, in the camera (*see* COLLODION POSITIVES); in the camera, &c., from a negative (*see* TRANSPARENT POSITIVE); or by the usual printing process (*see* PRINTING).

POSITIVE BATH. *See* PRINTING BATH and COLLODION POSITIVES.

POSITIVE FOCUS. *See* FOCUS.

POSITIVE PROCESSES. *See* COLLODION POSITIVES.

POSITIVE, TRANSPARENT. *See* TRANSPARENT POSITIVES.

POST-MORTEM PHOTOGRAPHY. Generally the illumination from an ordinary window may be made to give very good results. The light should be arranged to strike on the temple of the subject, not on the top of the head; the illumination as for an ordinary portrait being secured, as nearly as the circumstances will admit. Heavy shadows must be avoided, especially those cast under the brows, &c., by light striking directly on top of the head. Reflectors will aid in softening the shadows; and sometimes it is well to introduce diffused light from another window. All that can be obtained is the semblance of sleep. The trappings of the grave should be kept out of the picture.

POTASH. *See* POTASSIUM CARBONATE.

POTASH, BICARBONATE OF, $HKCO_3$. Hydrogen potassium carbonate is formed when a current of carbonic acid gas, CO_2, is passed though a strong solution of potassium carbonate. It may be considered a dibasic carbonic acid, H_2CO_3, in which one atom of hydrogen is replaced by one of potassium. It is a white salt, not so soluble as potassium carbonate. The solution is nearly neutral to test-paper.

POTASH, BICHROMATE OF. *See* POTASSIUM DICHROMATE.

POTASSIUM, K 39·04. Prepared by heating together potash and carbon to a high temperature in an iron retort. The carbon at the high temperature is able to take the oxygen from the potash, forming carbon monoxide, which escapes as a gas, whilst the metal potassium, which is volatile at a red heat, distils over. The preparation of this metal is attended with many difficulties, and requires special precautions, as the vapour of potassium not only takes fire when brought into contact with the air, but decomposes water, combining with the oxygen, and liberating hydrogen; hence the metal has to be cooled in rock oil or naphtha, which contains no oxygen. The metal thus prepared must be distilled a second time to free it of a black, explosive compound which sometimes forms in the original preparation, and has caused serious accidents. Potassium is a bright, silver-white metal, which may be easily cut with a knife. It is brittle at 0°; melts at 62·5°, and heated to a temperature below red heat it sublimes, yielding a fine, green-coloured vapour. Potassium rapidly absorbs oxygen on exposure to the air, and gradually be-

comes converted into a white oxide. In water, one atom of potassium displaces one of hydrogen from the water, forming potassium hydroxide, or potash, KOH; this takes place with such force that the heat is sufficient to ignite the hydrogen thus set free.

Potassium Bromide, K Br, forms brilliant cubical crystals, easily soluble in water, but in alcohol only in proportion to the amount of water it may contain.

Potassium Carbonate. K_2CO_3. Commercially known as potash or pearl-ash. The crude substance is prepared by boiling the ashes of plants with water, and evaporating the solution to dryness, from which a pure salt may be obtained by evaporating the impurities by crystallization. Potassium carbonate can be obtained perfectly pure, by heating pure potassium tartrate to redness, and separating the carbonate formed by dissolving with water. The salt is deliquescent, and therefore very soluble in water. It possesses a strong alkaline reaction.

Potassium Chloride, KCl, occurs in certain saline deposits, as at Stassfurt, and also exists in large quantities in sea water. It crystallizes in cubes like sodium chloride, and is much employed for the preparation of other potassium salts. Dissolves easily in water, but sparingly in alcohol. The crystals are permanent in the air, and taste somewhat like common salt. Sometimes known under the mineralogical name of Sylvine.

Potassium Cyanide, KCN, is formed when potassium is burnt in cyanogen, or in hydrocyanic acid gas, or when potash is added to hydrocyanic acid. Potassium cyanide is a white salt, very soluble in water and hot alcohol. It deliquesces in the air. It is a most violent poison, and should always be used with caution. Its principal use in photography is for fixing negatives.

Potassium Dichromate, $K_2Cr_2O_7$. If any chromic compound be fused with potassium carbonate, it becomes oxidized, and a soluble yellow chromate is formed, K_2CrO_4; this is the mode by which the chromium compounds are prepared from chrome-iron ore. This yellow chromate is isomorphous with potassium sulphate and manganate. When sulphuric acid is added to the solution of this yellow salt in sufficient quantity to combine with half the base, large red crystals of the dichromate separate out. This salt is commonly called bichromate of potash.

Potassium Ferrocyanide, K_4FeCy_6. Commonly known as yellow prussiate of potash. Prepared by heating nitrogenous organic matter with potash and iron filings. On dissolving the mass in water, and evaporating the solution, large yellow quadratic crystals of potassium cyanide, containing three atoms of water of crystallization, are deposited. When heated strongly it yields potassium cyanide and iron carbide, and when treated with dilute sulphuric acid, hydrocyanic acid is formed.

Potassium Fluoride. KF. A deliquescent crystalline compound, very soluble in water, forming a solution having an alkaline reaction and sharp taste. It forms double salts with other fluorides. At one time potassium flucride was used in the iodising solution for waxed papers.

Potassium Hydroxide. KOH. Caustic potash, white and crystalline, melting below a red heat to a clear liquid, and volatilising at a higher temperature. Exposed to the air it rapidly absorbs water, and becomes carbonated. It is very soluble in water and alcohol. Its solution is intensely alkaline; turns litmus paper blue, and turmeric paper brown. It neutralizes all acids, forming, for the most part, well-defined and crystalline compounds. It is of great value in the laboratory as a reagent.

Potassium Iodide. KI. This salt forms cubical crystals, usually white and opaque, which are permanent in the air. Obtained by dissolving iodine in solution of caustic potash, evaporating, and igniting the solid mass to redness.

Soluble in water, and very sparingly in alcohol. Inferior to some other of the iodides for use in collodion.

POTASSIUM OXIDES. Potassium combines with oxygen in two proportions, viz., potassium monoxide, K_2O, and potassium peroxide, K_2O_4.

POTASSIUM PERMANGANATE. $KMnO_4$. A dark purple salt in needle-shaped crystals; soluble in water. The solution readily parts with oxygen, especially in the presence of acids, and is therefore useful as an oxidising and disinfecting agent. In photography it is most useful for destroying organic matter in sensitizing solutions. To restore a silver bath, add drop by drop the solution of the permanganate, shaking the bath solution constantly. While organic matter is in solution, the pink tint communicated to the bath will die away after two or three minutes. Add more permanganate solution, and if after (say) three minutes the pink tint remains, place the bath solution in the light until it clears. Filter. A negative bath may require acidifying after the filtration.

POTASSIUM SULPHURET. Used in photography for the purposes of strengthening the negative, and precipitating wastes. It is of unpleasant odour, and negatives strengthened by it are subject to rapid decomposition.

POUND. (*A.S.* and *Lat.*) Weight consisting in troy weight of twelve, in avoirdupois of sixteen ounces. A pound troy is equivalent to 5,760 grains, a pound avoirdupois to 7,000 grains. *See* WEIGHTS AND MEASURES.

POWDER PROCESS. Various substances are available for the support of the picture, but none is better than opal glass, ground and smoothed, but not polished, with a surface like dead unpolished marble. The surface is well rubbed with a creamy mixture of chalk and water, and then well washed with clean water flowing from a tap. It is drained, but not dried, and is ready for coating with the sensitive syrup. Water, 1 ounce; dextrine, 24 grains; grape sugar, 24 grains; bichromate of potash, 24 grains: or by another formula with gum:—Water, 6 ounces; honey, 1 drachm; glucose, ½ ounce; gum arabic, ¼ ounce; saturated solution of bichrom. ammon., 1¼ ounces. This is poured on gently, so as to cause it to flow in an even wave over the plate, driving the water before it. The first coating applied is wasted when poured off the plate, and it takes with it the water. The second coating is then applied, and the surplus returned to the bottle. The film is now dried by the aid of a bright, clear fire, or of the flame of a Bunsen gas-burner. It is, when quite dry, and even warm, ready for exposure under a transparent positive. Mastery over correct exposure can only be gained by practice; for although a practised eye can detect the change in colour going forward, this cannot be much relied on. A similar judgment to that required in timing a negative must be used: about three or four minutes in a good light. Under-exposure will produce a black, heavy picture; whilst slight over-exposure may be corrected, and made to yield a fine print by patient and careful development. The dark room should have a well-ventilated atmosphere, and have no draughts or currents of air. The plate is removed from the pressure-frame, and again thoroughly dried by heat. It is best to begin the development with the film quite dry, as a better estimate can be formed then of the exposure and the care required in development. The development is effected by the application to the film of the powder which is to form the image. For ordinary purposes it consists of ivory black and Indian ink very finely powdered. The colours should be purchased of the artists' colourman as finely ground as possible, and then well ground together again in such proportions as may give the desired tint. Indian red may be used alone to give the tone of red chalk, or black alone to give the cold black of engravings; or sepia, or indeed any tint which may be desired. It is applied to the film gently with a large camel's-hair brush. At this stage of the pro-

cess very much rests under the control of the manipulator. Almost any depth in any part may be obtained by patient and continued application, so that the manipulator with artistic taste may materially modify the light and shade of the picture at will; whilst the careful, but mechanical, printer will produce an exact transcript of the negative. It must be borne in mind that depth is obtained by patient re-application, rather than by any attempt to cause much powder to adhere at once. If the plate appear to have been over-exposed, so that the powder seems indisposed to adhere, there is a temptation to breathe upon the plate. This is a dangerous proceeding, and may cause the next application of powder to adhere in a patch. As each stage of the result is visible, it is not difficult to judge when the development is complete, or when a shadow requires a little deepening, or even, if desirable, light and shade introduced into a background which may be quite plain in the negative. Vignetting is also easily effected. When the image is complete, the next step is fixing it. An ounce of alcohol and water in equal parts, and about half-a-dozen drops of sulphuric acid, which, being a good solvent of bichromate, rapidly aids in removing all the unchanged chrome salt. This is poured gently on the film, as at this stage it is tender, and is easily injured. Some use strong alcohol alone, and in subsequent washing add sulphuric acid to the water. After pouring off the fixing solution, the plate is very gently placed in a dish of water, which must be changed gently three or four times. The image is then dried by gentle heat. Care must be taken to keep white light from the image until all the bichromate is removed by washing.

PRECIPITATION. (*Lat.*) When solid matter suddenly separates from a liquid, or is separated by mixing different liquids, the matter so separated is called a precipitate, and the operation, precipitation.

PRECIPITATION OF SILVER. *See* NEGATIVE BATH, TO RESTORE.

PRECISION. (*Fr.* and *Lat.*) In making up formulæ and in the conduct of manipulations, precision should be observed. Failure is generally the effect of inexactness and uncare.

"PRESERVATIVE." In some dry plate processes, especially where a washed emulsion is used, it is necessary to coat the plate with a preservative solution. This is thought by some workers to ensure adherence of the film to the plate, greater and more even sensitiveness of the film, and to secure freedom from spots. Many preservatives are in use, of which the most generally used are albumen, tannin, beer, coffee, tea, gum, &c. *See* DRY-PLATE and EMULSION PROCESSES.

PRESERVED SENSITIZED PAPER. *See* SENSITIZED PAPER, PRESERVED.

PRESSURE FRAMES. *See* PRINTING FRAMES.

PRIMARY COLOURS. *See* NOMENCLATURE OF COLOURS.

PRINCIPAL AXIS. *See* LENS.

PRINCIPAL FOCUS. The point where rays originally parallel meet.

PRINT. (*Fr.* and *Lat.*) The impression taken by the action of light, upon sensitized paper, of the image on the negative.

PRINTING. In printing from a negative (the ordinary operation of exposing paper and negative to light), there is scope for the exercise of taste and skill to a far greater extent than would strike the careless or inexperienced printer. As regards the negative, a knowledge of its good and bad qualities as a printing medium is absolutely necessary, to make the most of the beauties, and to remedy the defects. The treatment required for negatives of different character varies greatly. This, true where the variation is due only to the character of the subject portrayed, is perhaps more easily recognized where the difference between the negatives is caused by change of

manipulation, by accidents, or by alteration of the chemical or actinic conditions under which the negative is produced. Two extreme cases of this kind are treated under the head of PRINTING INTENSE, and WEAK NEGATIVES. It is necessary too, as regards the paper, that it be handled carefully, so that it may not be stained; cut properly to avoid waste; adjusted on the negative so that the print will occupy its proper position on the paper, care being taken that defects in the piece of paper may not come in an important or prominent part of the picture; it should be seen that the pressure is equal, neither so much that the safety of the negative is endangered, nor so slight that the paper may slip when the frame is opened to see the progress of the printing. The exposure of the print also calls for no small share of taste, skill, and attention. The rapidity of impression best suited to the negative is a consideration of extreme importance. The mistakes of staining the sensitized paper by exposure to light; of partial printing, where a shadow is allowed to darken a portion of the negative; of exposing the wrong side of the paper; of breaking the negative; and a dozen other failures, need not be enumerated here.

PRINTING BATH. For general use, we find in a bath of medium strength a good serviceable bath, easily kept at its normal strength, suitable for most work, not subject to variation nor prone to getting out of order, and when disorganised easily restored. *The Plain Silver Bath.*—Silver nitrate, 40 grains; water, 1 ounce. A small amount of solution is productive of many evils. The amount of silver in it, being small, is soon exhausted. It is contaminated after sensitizing a sheet or two of paper only, and requires doctoring every day or so. The depth of solution should not be less than an inch, and it is best to sensitize in a bath which will contain at least a half sheet. For strengthening the solution when required, a stock solution of silver nitrate, 60-grains strong, dissolved in *distilled* water, should be kept, as a great deal depends on maintaining an even strength. By this means only can certainty of working be attained. The hydrometer indicates, with sufficient exactness for this purpose, the strength of the bath solution. A great deal has been written about the water best adapted for use in the sensitizing bath for printing, as well as for negatives. Generally, particular direction is given that distilled water must be used. That this is best there can be no question; but the writer has found ordinary cistern water serve the purpose exceedingly well, if treated in the manner here given. When the silver is dissolved, make slightly alkaline by the addition of a drop of ammonia solution (one drop of ammonia in ten of water), and expose the solution in a clear glass vessel to daylight for a few hours. The solution will grow muddy, and then a brown precipitate will be thrown to the bottom of the vessel; decant the clear liquid, and filter. With the silver nitrate other nitrates are sometimes used, to suit special brands of albumenized paper. One of the most generally used baths is the following:—Silver nitrate, 40 grains; ammonium nitrate, 20 grains; water, 1 ounce, made alkaline with liquor ammoniæ. And to the same formula, the addition of five grains of lead nitrate has been recommended. This bath is well adapted for use with most brands of paper, but requires care to keep it in working order above that of the plain bath. The solution should be kept, as far as possible, on the *surface* of the paper. This necessity influences the duration of the sensitizing, especially where the bath is weak and the tendency of the solution is to dissolve the albumenized surface. "Woolliness" and want of vigour in the image, and an unpleasing insunken appearance of the print, mark this fault. To prevent this, alum is sometimes added to the silver solution, its action being to harden the albumenized surface of the paper and

prevent the silver sinking through. It is generally added by placing a small lump of alum in the filter when filtering the bath. It is only necessary to do this when the prints show the want, and only then when the fault is known to be in the bath; or too much will be dissolved. The bath solutions, we have seen, are made alkaline This should not be very decided, and the addition of the alkali should be carefully made. Liquor ammoniæ should not be poured in undiluted, but drops of a solution in water, one in ten, used when the silver solution shows an acid reaction. This is ascertained by the use of litmus paper; the red paper ought not to change to blue quickly and strongly. For rendering the bath alkaline, bicarbonate of soda is sometimes used, but the ammonia solution is to be preferred. By some workers an acid sensitizing bath is recommended. The effects obtained cannot be compared with those from an alkaline solution, nor is the paper so sensitive. The value of a bath acidified with citric acid will, however, be found in the keeping qualities of the paper sensitized on it. The use of nitric acid in the bath is not recommended, as the prints resulting are weak and poor, and tone tamely. The acid bath, except for special purposes, is to be discommended for three important reasons. First, that the results are not so fine as those obtainable by the alkaline bath; second, that the action is slower; and third, the bath is not so easily purified. The alkaline bath may be placed in the sun, and all impurities are, by its action, thrown down and may easily be filtered out. Glycerine and alcohol are sometimes added, but the advantage gained by the use of either is extremely questionable in general work. Care in all cases will do away with the necessity for continual doctoring of the solution. Filter after each time of using, and strengthen; but do not worry the bath until it begins to worry you. Test with litmus paper every now and then, to see that the proper degree of alkalinity is maintained.

Printing Bath, to Restore. The sensitizing bath soon becomes discoloured by the dissolution of albumen from the surface of the paper. With some brands of paper, after a few sheets have been sensitized, the solution assumes a deep colour, and the purity of the whites of the print is seriously affected. This, in the case of vignettes, is a fatal defect. Decolorization of the bath may be effected in several ways; but of these, three commend themselves on the score of efficacy, ease of application, and economy. For the renovation of a comparatively new bath, the application of kaolin or of a dilute solution of potassium permanganate will be found most useful, and to serve every purpose; and for a somewhat worn bath partial evaporation or boiling. *Potassium permanganate.*—The great advantage the use of the permanganate offers is that of readiness. With a stock solution at hand—potassium permanganate, 20 grains; water, 1 ounce—we may, without great delay, purify the bath even while it is in use, but this need only to be done in time of great pressure. After the completion of sensitizing the paper for the day, if the bath be much discoloured, add two drops of the permanganate solution to the bath, and thoroughly mix by stirring with a glass rod. The bath assumes a deep rose tint, which in a short time lightens. If it rests at this, sufficient has been added; but if the tint dies out entirely, another drop must be given, or yet other drops until the solution is coloured. The quantity depends, of course, on the bulk of the bath solution. The tinted bath solution, placed in a clear white glass bottle, is stood in sun- or day-light until the rose tint disappears (say, after an hour in sunlight), and the solution filtered clear. *Kaolin*, or porcelain clay, the purest form of disintegrated felspar, is, too, a useful agent for purifying the bath. A little of the kaolin is placed in the bottle containing the bath solution, shaken up together for a little time, and then allowed to settle. The clear liquid is

decanted and filtered. The kaolin may be left in the bottle, and the solution added to it several times. After a time the bath will, from various causes, require more thorough renovation; but until the methods just described fail, it is well not to resort to boiling. "*Boiling*" *the bath.* At times a partial evaporation of the solution is all that is required. In this case it is only necessary to pour the solution into an evaporating dish, and place over the lighted jets of a gas-stove. Should the bath not be alkaline, it must be rendered so by the careful addition of a solution of liquor ammoniæ, with the precautions already enjoined. When the liquid is thoroughly heated, it will grow turbid and black, with a metallic scum on the surface. Under this scum, after a time, the solution will clear, the impurities being thrown down. At this stage, or when about one-quarter or one-third of the solution has evaporated, the gas of the stove may be turned off and the solution allowed to cool. When perfectly cool, filter; and having ascertained the strength of silver, add sufficient distilled water to reduce to the original strength of the bath. If distilled or pure water is not at hand, ordinary cistern water may be used, but it should be added *before* subjecting the bath to heat; diluting the solution in the first place, and boiling down as nearly as possible to the proper strength. In this way we get rid of the impurities of the water with those of the bath. *Fusing the Bath.*—The operations described in the previous process are in this carried out, but the evaporation is continued to dryness. The bath is now fused until all frothiness disappears. Heat should now be withdrawn, and the mass scraped down into the centre of the dish. When sufficiently cool, enough nitric acid solution (one part in ten or twelve of water) should be added to redissolve the silver with the aid of heat. Again evaporate to dryness, and dissolve once more in pure water, and filter. The bath may now be made up to the required strength, the organic matter having been rendered insoluble by fusing, and the excess of acid dissipated. In boiling baths certain precautions are necessary, or accidents are likely to occur. A good porcelain dish should be procured, and this will bear almost any amount of heat, but a sudden wave of cold air on the heated surface may crack or break it. Sometimes, by way of extra precaution, is used a "sand bath," or iron bath filled with fine sand, in which the porcelain dish is stood. By the use of the sand bath a more uniform heat is maintained, and danger of cracking the porcelain dish is averted. Iron dishes lined with porcelain should not be used, as the surface is liable to fracture. When nothing can be done to make a bath work, the best plan to adopt is that of the *precipitation of the silver in a metallic state.* Filter the solution, and place in it strips of copper. After twenty or twenty-four hours, test the solution for absence of silver by taking a few drops in a tube, and adding a solution of common salt. If there is no white precipitate, the silver has all been reduced to a metallic state. Decant the liquid, and wash the silver until the greenish colour observable, which is due to copper nitrate, disappears. Place the metallic silver in an evaporating-dish, and gradually add one drachm of nitric acid for each 150 grains of silver nitrate of the original solution, to dissolve the metallic silver. Dissolution is aided by gentle heat. Boil down the solution to free it of nitric acid, add distilled water, and then silver oxide, gradually, until the greenish tint disappears. Filter, and make up to the proper strength. Or, by placing in the filtered solution clean, bright strips of zinc, the silver will precipitate as with the copper in the foregoing. To get rid of the zinc, after picking out the undissolved pieces of zinc, add a mixture of hydrochloric acid, one part in ten of water, and boil; pour off the acid and well wash the silver. Place the mass in a filter, and wash well with boiling distilled water. Dissolve with nitric

acid, as already described, filter, and make up to the required strength.

Printing by Development. The paper is salted with the following solution:—Potassium iodide, 10 grains; potassium chloride, 40 grains; tapioca, 20 grains; lemon juice, 16 minims; distilled water, 2 ounces. Dissolve the salts in the water, add the lemon juice, and boil; mix the tapioca with a little cold water, and add to the hot solution, stirring well. Brush this over the paper, and dry. Sensitize on a solution of silver nitrate, 40 grains; citric acid, 3 grains; water, 1 ounce; floating two minutes. The exposure is not carried beyond the faint appearance of outline of the image. Develop by floating on gallic acid, saturated solution, one part with four parts of water. Wash well. Tone with gold, and fix in sodium hyposulphite. By another process, plain paper is immersed for two hours in sodium chloride, 100 grains; hydrochloric acid, 6 minims; distilled water, 10 ounces. Dry, and sensitize for two minutes on a 40-grain silver nitrate solution with one grain of citric acid. Develop with pyrogallic acid, 2 grains; citric acid, 1 grain; water, 1 ounce. Wash, tone, and fix. Albumenized paper may be used by sensitizing on a 40-grain silver nitrate bath acidified with 30 grains of acetic acid; and developed with one part of a saturated solution of gallic acid in four parts of water. Wash, tone, and fix as usual.

Printing, Combination.—Impressions of portions of two or more negatives are sometimes made on one print, the result being termed a combination or composition picture. The ordinary form of combination printing is that used in landscape work, where the sky is photographed on a separate plate. By this means may be obtained detail which could not be obtained with the landscape. Thought and knowledge of effect are required to produce a work of art by means of combination printing. The portion of the landscape negative occupied by sky is covered with black varnish, on the glass side, to secure softness in the edges. From this a print is made, the sky appearing pure white. The print is then placed in the printing-frame with the negative of the sky, of which the landscape portion has been blotted out. Figure-subjects in which landscape effects are introduced are made up by the same means. It is in all combination printing of the greatest importance that there should exist perfect harmony between the negatives used; that the joining lines of the different cliches are never abrupt, or with any white space between; and that the picture secured is consistent with truth. Large groups of figures may be made by combination of several negatives. For this a sketch should first be prepared to guide the artist in making the several negatives. The junctions should be made to fall in unimportant places.

Printing Frames should be made of well-seasoned wood, that they may not warp under the influence of the weather. For vignettes, the front edge should be deeper than in the ordinary frame, to hold the vignettes at a proper distance from the negative. Where they approach each other closely, the outline of the vignette is harsh and inartistic. Each frame should be provided with a clean sheet of glass on which the negative may rest. This precaution will save many negatives.

Printing from Ferns and Leaves. *See* Ferns.

Printing Intense Negatives. Negatives with strong lights, and dark, abrupt shadows, little detail, and plenty of harshness, must be printed as rapidly as possible to subdue the contrast. It is well to use a pink-tinted paper, and in some cases, where the negative is destitute of half tones, to slightly discolour the sensitized paper by exposure to diffused light.

Printing in the Solar Camera. The negative for printing in the solar camera should be clear and sharp, with good detail, and clean transparent shadows. Glass entirely free from flaws should be used for making the negative. A pure sensitizing bath,

decidedly acid, will give a thin clean negative with plenty of detail, and clear glass in the shadows, such as is required for solar printing. The negative should not be varnished, but if retouching is necessary a dilute solution of gum arabic may be poured over the plate, while still wet, after the fixing and washing, and this will give a splendid surface for the pencil. The less work the better. The prints may be made on albumenized paper, but enlarged prints, unless worked up by the artist, are seldom satisfactory. Plain prints may be made on the plain side of an albumenized sheet, or on plain paper, and developed. *See* PRINTING BY DEVELOPMENT.

PRINTING ON CANVAS. Prepare the surface of the canvas by rubbing over it, with a rag, the following solution:—Liquor ammoniæ, 1 ounce; potassium cyanide, ½ ounce; water, 4 ounces. Rinse with water, and then pour over acetic acid; rinse and dry. Prepare (No 1) gum benzoin, 24 grains; alcohol, 1 ounce; (No. 2) citric acid, 30 grains; alcohol, 1 ounce; (No. 3) strontium chloride, 18 grains; alcohol, 1 ounce. The chloride is first dissolved in the smallest quantity of water, then added to the alcohol. Mix the solutions in equal proportions as required for use, and pour over the surface of the canvas. When dry, sensitize with the ordinary ammonia nitrate of silver solution. In the solar camera, the canvas may be printed while still wet. The toning and fixing may be done together or separately; the fixing should not be carried too far. The carbon process always affords a ready and sure method. Rub the canvas with dilute spirits of wine or carbonate of soda to remove greasy lines. Pour on a little water, the carbon tissue dipped in water and placed face downwards on the canvas. Pour on slightly warm water, remove the paper support as the tissue softens, and the print develops as more warm water is poured over.

PRINTING ON LINEN, SILK, ETC. The starch in linens and other stuffs must first be removed by washing. Albumenize by floating for five minutes on a solution of twenty grains of ammonium chloride in five ounces of distilled water, and the white of one egg well beaten up, and filtered. For linen, a shorter second floating is sometimes required. When dry, the stiffened material should be rolled. Sensitize for five or six minutes in a sixty-grain silver nitrate bath, dry, and place the piece of material in the frame. Print darker than on paper. Tone and fix in the ordinary solutions. Wash thoroughly. The print may be polished by ironing with a smoothing iron. Silk and satin prints should be protected by a damp cloth when ironed.

PRINTING ON PLAIN PAPER. Float the paper for fifteen seconds on a bath prepared as follows:—Ammonium chloride, 250 grains; gelatine, 15 grains; water, 30 ounces. Dissolve the gelatine in hot water, add the chloride, and filter. Filter the bath after each time of using. Dry the paper by heat. Sensitize on a pure silver nitrate bath forty grains strong; or a forty-grain ammonio-nitrate bath. Fume as usual. In washing plain prints, great care is required, as the paper is likely to tear when wet. They had best be toned before the albumenized prints, and with especial care. For artistic work, cold tones are required. Burnishing should on no account be allowed, the beauty of plain prints being their want of gloss. They are generally mounted, with uncut edges, on cardboard, and covered, when finished by the artist, with a passepartout.

PRINTING OVALS. Between the negative and the sensitized paper is placed a piece of opaque in which an oval opening has been cut. The print is made, and is thus of oval shape. It is then removed from the frame, placed on a piece of glass, and covered with the oval cut from the opaque paper already used. The print is covered by the oval, attached to a glass plate, and the white margin of the print exposed to light

until slightly tinted. Sometimes, instead of plain glass, a negative taken from rough drawing paper, marbled paper, fine rulings, and other designs is used to cover the print, so that the margin of the print bears a design instead of a plain tint. By placing the oval mask a trifle over one edge of the print a white line on one edge and a dark line on the other edge is made. The negative taken from rough drawing paper forms a very pleasing and artistic margin for an oval portrait. The tint of the margin should be very faint.

PRINTING PROCESS consists of five operations:—1. *Sensitising the Paper.* (*a.*) The bath solution is conveniently placed in a flat dish. (*b.*) The sheet laid on the solution. (*c.*) Time of floating according to temperature, &c. (*d.*) Sheet raised and hung to drain. 2. *Drying and Fuming.* (*a.*) Remove the paper to the drying room. (*b.*) Suspend sheets over gas or stove. (*c.*) Dry. (*d.*) Fume. 3. *Exposure.* (*a.*) Cutting the paper to required sizes. (*b.*) Carefully placing the negative in frame. (*c.*) Dusting the negative. (*d.*) Laying on the paper. (*e.*) Evenly padding the back. (*f.*) Shutting the frame. (*g.*) Exposure to light. (*h.*) Care in examining the print, which should never be done in strong light. (*i.*) Cutting the print. 4. *Toning.* (*a.*) Washing the prints. (*b.*) Toning. (*c.*) Fixing. (*d.*) Thorough washing. 5. *Mounting and Finishing.* (*a.*) Pasting the back of the print. (*b.*) Placing on the card. (*c.*) Drying. (*d.*) Burnishing. (*e.*) Waxing. Details of these several manipulations will be found under their special headings.

PRINTING, SOLAR. *See* PRINTING IN THE SOLAR CAMERA,

PRINTING THIN NEGATIVES. Slow printing is necessary for thin negatives, sometimes two or three thicknesses of tissue paper being required. A strong silver bath should be used in sensitizing the paper. Thinness of itself is not a fault in the negative, if the balance of light and shadow be maintained, but if the thinness means poorness the negative had better be discarded.

PRINTING, TREATMENT OF NEGATIVES BEFORE. A negative should never be put into a printing frame until the printer has satisfied himself that it is as perfect as possible. Any transparent marks on the background left by the retoucher should be touched out. A little consideration of the negative may suggest treatment which will produce better effects than if passed through the ordinary routine. The film must be brushed each time, before placing on it the piece of sensitized paper, to remove any adhering dust. Each speck of dust causes a defect in the print.

PRINTING VIGNETTES is effected by shading the background all round the figure so as to secure a gradual fading away of the background and some part of the dress, thus giving a margin of white paper round the image. This is done by placing over the front of the printing frame an oval mask of opaque paper, the edges being notched to secure softness of outline. Over the opening a piece of tissue paper is pasted to further induce softness, and the print made in the shade. The vignetter must be placed at some distance from the glass, and frames with a deep bevelled front are usually provided for the purpose. By these means a white vignette is secured. The vignetted image should be oval in form, the background round the head and the dress below imperceptibly merging into white, without outline. To grey the background, the print is placed between two clean glasses, and with a tuft of cotton placed over the vignetted image (outside the top glass) exposed to weak diffused light; or by a surer, if more difficult process, placing an oval piece of card over the top glass, and exposing the print in diffused light while the cardboard is kept moving over the image, and the glasses rotated on the hand. The constant rotary movement of the glasses with the print between, exposes the whole without the

shadow cast by the hand injuring the print, and the motion of the piece of card constantly maintained secures a soft outline to the grey background.

PRINTING VIGNETTES, FAILURES IN. Vignettes harsh and inartistic are from placing the vignetter too near the negative, or from too strong light; bad shapes from ill-cut vignetting-forms, or from the light striking the vignetter obliquely, so that the illumination is one-sided. Ill-balanced vignettes appear when, with a graduated background, the dark side is not shaded in proportion to its depth of tone. In greying the vignette the printed-in background should never be darker than that printed from the negative. Many faults arise from want of taste and skill.

PRINTS, CUTTING. *See* CUTTING PRINTS.

PRINTS, RECORD OF. In making a given number of prints from any negative, it is necessary to keep account of them as they are produced. This is sometimes done by placing the number of each, in small figures, at one corner of the print. This, however, gives trouble of reference when the printing extends over several days. The best plan is that of having a little piece of slate inlaid in the back of each frame on which the number of print required, and the progressive number of the print, as, for instance, $\frac{12}{5}$ indicates that twelve prints are to be made from the negative, and that the fifth print is in the frame.

PRINTS, TONING. *See* TONING.

PRINTS, WAXING. *See* WAXING PRINTS.

PRISM. (*Fr.* and *Gr.*) In Optics, a prism is a triangular-shaped piece of glass or other transparent medium with polished sides. The section may be either a right-angle, an equilateral, or an isosceles triangle. The equilateral and isosceles prisms are employed for effecting the prismatic decomposition of light. When a ray of light falls obliquely upon one of its refracting surfaces, it passes through, and emerges at the opposite face, suffering at its ingress and egress two refractions in the same direction, whereby, unless the light be homogeneous, the ray is spread out into its component colours, forming a spectrum. When a ray of light enters one of the sides of a right-angle prism perpendicularly to it, the ray suffers total reflection from the interior surface of the hypothenuse, and emerges from the opposite side, the ray being bent 90° from its original path without suffering refraction. When the ray of light enters the prism parallel to the hypothenuse, it is refracted to that surface, then totally reflected to the opposite side, and is again refracted on emerging, so that its original direction is preserved, and as the two refractions neutralise each other, there is no dispersion. Owing to the single reflection it suffers, the pencil of light is inverted; and, therefore, objects viewed through a reflecting prism in this direction appear in their right places, but with their sides reversed. Used in this manner, a right-angle prism is sometimes called a reversing prism.

PROCESS. (*Fr.* and *Lat.*) The whole course of an experiment or series of operations, tending to produce something.

PROFILE. (*Ital.*) A head, &c., represented sideways, or in a side view. The view generally adopted for the presentment of images on medals, coins, &c.

PROMENADE PICTURE. The title of a new size for photographs, specially designed to meet the requirements of the present style of drapery. The picture was intended for the photographs of persons in walking costume.

PROOF. A print more or less in a state of unfinish prepared for approval of the sitter. Usage varies greatly with regard to the showing of proofs, as well as in the degree of finish imparted to the print. In some galleries the proof is a first impression for which charge is made; at other establishments the negative is partly retouched, and from it a print made, properly mounted and burnished, and this submitted to the sitter without charge. As a matter

of policy there can be no doubt that, for a generous treatment of the sitter, the photographer is fully repaid both in success and in pleasant and amiable relations with his customers. *See* RESITTINGS.

PROOF SPIRIT. Spirit wherein the pure alcohol is beyond a certain quantity.

PRUSSIAN BLUE. $Fe_4\ K_2\ Cy_{12}$. Ferric salts produce with solutions of potassium ferrocyanide a deep blue precipitate of soluble Prussian blue. This substance is insoluble in saline solutions, but dissolves in pure water with a deep blue colour. In this liquid an aqueous solution of a ferrous salt produces a deep blue precipitate of insoluble Prussian blue, $Fe_5\ Cy_{12}$. This valuable pigment is manufactured on a large scale by precipitating yellow prussiate of potash with protosulphate of iron (green vitriol) which has been exposed to the air, and then washing the precipitate with chlorine water.

PRUSSIC ACID. *See* HYDROCYANIC ACID.

Pt. The chemical symbol of Platinum.

PUMICE POWDER for retouching: grind together two pieces of pumice stone, catching the powder on a piece of fine muslin. Gather up the muslin into the form of a bag. *See* RETOUCHING.

PURPLE OF CASSIUS. A splendid purple colour, formed when gold chloride is added to a dilute solution of stannous chloride. *See* GOLD TRICHLORIDE.

PYROGALLIC ACID, OR TRYHYDROXYL BENZENE. $C_6H_3\ (OH)_3$. A product of the action of heat on gallic acid. It crystallizes in long white needles, very soluble in water. It acts as a powerful reducing agent, and is much used in photography in the dry plate and emulsion processes, *q.v.*, and in intensification, *q.v.*

PYROLIGNEOUS (*Gr.*, *Lat.*) A term applied to certain products from the distillation of wood.

PYROTECHNIC LIGHTS. *See* ARTIFICIAL LIGHT.

PYROXYLIN, used in photography in the preparation of collodion, is cotton or fibre, the chemical composition of which has been changed by the action of a mixture of nitric and sulphuric acids. It is not advisable for the photographer to prepare the pyroxylin he requires himself, as many of the commercial samples are of first-rate quality, and the difficulties attendant on preparation are great. Hardwich's method, which will be found very serviceable, is as follows: Sulphuric acid (1·845 at 60° Fahr.), 18 ounces; nitric acid (1·457 at 60°), 6 ounces; water, $5\frac{1}{2}$ ounces. Add to the water the sulphuric acid, and then the nitric acid. Stir well, and when the temperature is reduced to 150°, immerse 300 grains of cotton, in pieces, well pulled out. Each piece of cotton should be thoroughly wetted by the acids. When all the cotton is immersed the vessel should be covered for nine minutes, at the end of which time the cotton is removed in one lump with glass spatulus, squeezed dry, and put into a large dish of water. The mass is now washed in frequent changes of water, and afterwards in a tray, left under a tap of running water for twenty-four hours. A final washing is given for two or three hours in a washing cylinder under a strong flow of water. Squeeze, and pick out the cotton, and dry it upon a cloth. Two or three days' exposure to the air will probably be required to dry it. The cotton should have gained about twenty-five per cent. in weight. With a larger increase the collodion prepared with it will probably be thick, and give streaky pictures; with little or no increase of weight the pyroxylin gives a limpid and structureless collodion, less liable than where the increase is great, to markings on the plate, with considerable softness of the image of the negative.

QUALITATIVE ANALYSIS. The resolution of a compound body into its consitutent parts for the purpose of discovering what it is composed of. This is sometimes done by means of heat tests; heat and flame especially producing remarkable changes in the appearance of some bodies. The other principal method being by getting the body into solution, and adding other

liquids called tests or re-agents. The mixing together of these liquids is designed to produce precipitation of a solid substance in the liquid, a change of colour, an effervescence of gas, or some other phenomena which can readily be detected by sight, smell, or taste; and the comparison of the result with what we should expect from previous knowledge to take place if some supposed body were present, indicates to us whether it is so or not. Of these methods there are numberless variations, altering more or less with every fresh case. The spectroscope affords very great help in qualitative analysis, especially in delicate and intricate tests.

QUANTITATIVE ANALYSIS. Determination of the relative quantities in which the constituents of a compound are present in it. Two methods are generally adopted, which are known as analysis by weight, and volumetric analysis. The general principle of the first is to combine the elements one after another by precipitation with some other elements or groups, and thus to form insoluble compounds. These precipitates are collected and weighed, and by calculation from the results obtained it is easy to deduce the numbers required. The other method is frequently used when it is only required to know the quantity of some one body present in the known weight of a given specimen.

QUARTZ. *See* ROCK CRYSTAL.

QUICKNESS OF LENSES. *See* RAPIDITY.

RADICAL. (*Lat.*) The basis of a compound. *See* RADICAL, COMPOUND.

RADICAL, COMPOUND. In organic chemistry, a compound radical is a group of elements which in the various changes and decompositions which a substance undergoes remains unaffected, and acts as if it were an element.

RAISIN PROCESS. A dry plate process in which a decoction of raisins is used as a preservative.

RAPIDITY is only to be gained by the use of lenses of great power, good light well used, and pure chemicals. As regards light, quality is of greater importance than quantity; as, where the illumination is skilfully concentrated on the object, rapidity with fine artistic effect is obtained, not with the flood of diffused light from a large expanse of glass. Pure uncontaminated chemicals are also requisite; the sensitizing bath not too acid; the developing solution prompt of action.

RAPIDITY OF THE LENS depends on the opening or diameter, and on its focal length.

RAY. (*Fr.* and *Lat.*) A beam of light, propagated from a radiant point; said to be direct when it comes direct from the point; reflected if it strikes upon anything, and is thence transmitted to the eye. The mixed solar beam contains calorific rays, producing heat and expansion; and chemical rays, producing certain effects on the composition of bodies, but neither heat, vision, colour, or expansion.

REACTION, CHEMICAL. The mutual action of chemical agents on each other. *See* REAGENT.

REAGENT. A chemical test which serves to distinguish the presence of a substance or group of substances by the mutual action they exert on one another.

REAUMUR THERMOMETER. *See* THERMOMETER.

RECEPTION ROOM. An apartment in the gallery set out for the reception of visitors, the transaction of business, and for the purposes of a waiting-room, &c. It should be bright and cheerful, and objects of taste and interest should adorn the walls, and be spread about the room, in order that those awaiting their turn for sitting may not be troubled with *ennui*.

RECORD OF PRINTS. *See* PRINTS, RECORD OF.

RECTIFICATION OF BATH. *See* NEGATIVE, and POSITIVE BATH, TO RESTORE.

REDEVELOPMENT. Intensification of the image on the negative after fixing. The operation, unlike intensi-

fication, *q.v.*, may be conducted in subdued actinic light. The fixing solution must be thoroughly washed from the surface of the negative before application of the redeveloping solution.

REDUCING INTENSITY OF NEGATIVE. *See* NEGATIVE, TO REDUCE INTENSITY.

REDUCTION. (*Lat.*) The separation of oxygen, chlorine, or allied elements from a metallic compound so as to leave the pure metal, is usually termed reduction; but the term is frequently extended to an incomplete action of this sort.

REDUCTION OF SILVER TO METALLIC STATE. *See* NEGATIVE BATH, TO RESTORE.

REDUCTION OF WASTE. *See* WASTE, REDUCTION OF.

REFLECTED LIGHT in photography, that cast on the sitter by means of reflectors, and used to light up shadows which are too black. Care must be exercised that the reflected light is not so strong as to destroy the shadow, the object in using a reflector being only to secure modulation, which would be lost in heavy shadow. To secure the proper effect in portraiture, the reflector should be of a dead surface, and not perfectly white in colour. The use of mirrors cannot be too strongly urged against.

REFLECTING PRISM. *See* PRISM.

REFLECTOR. In photography, a screen covered with light cloth or paper, and used for the purpose of throwing light upon the shaded side of the sitter. It will usually be found, in lighting a photographic subject, that the shadows formed appear blacker on the sensitive plate than in nature, and that the form of the model is often entirely lost. The reflecting screen is therefore placed at a distance from the object on the shaded side, and the light reflected from the surface of the screen lights up the shadow, and restores form to the image. The distance from the object at which the reflector is placed regulates the amount of illumination, which must, of course, never nearly approach in intensity that of the light side. Several complicated reflectors are in use, but for all ordinary purposes the plain screen hung in a frame to secure the proper angle will serve well. *See* REFLECTED LIGHT.

REFRACTION. (*Lat.* and *Fr.*) In Optics, when a ray of light passes obliquely from one transparent medium to another of different density—such as from air to glass, from glass to water, &c.—it is refracted or bent out of its course. Some crystals possess the quality of double refraction. *See* PRISM.

REFRANGIBILITY. (*Lat.*) The property which rays of light possess of being bent out of a straight line when they pass from one medium to another of different density.

RELIEF (*Italian*). A term used to express a quality in the negative, produced by the illumination, giving the image formed on it an appearance of roundness. Although an admirable quality, it may be carried to excess; and this forms a vulgarism. Sometimes termed roundness, rotundity, &c.

REMBRANDT EFFECT. Portraits in which the shaded side of the face is portrayed are somewhat fancifully called "Rembrandt portraits," in the idea that they resemble the effects of the master after whom they are styled. The sitter is placed more or less with the light behind the head, the camera being drawn under the boarded-up portion of the roof, so that the side of the face turned to the lens is more or less in shadow. The strong streak of light down the line of the nose should be avoided, or the outline will be lost on the illuminated cheek beyond. Care must be exercised that the lights in the eye are not too strong, and that generally the contrast is not harsh. This form of lighting should only be adopted when it is suitable to the sitter, not made an excuse for extorting an extra fee from the customer.

REMOVING FOG. *See* FOG, TO REMOVE.

REMOVING OLD FILMS. *See* ALBUMENIZING.

REMOVING VARNISH FILMS. It is sometimes found necessary to remove the protecting film of varnish from a negative. An alcohol varnish may be washed off by pouring alcohol on and off the film. The operation requires patience and care.

REPRODUCTION OF DRAWINGS, PAINTINGS, ETC. *See* COPYING.

REPRODUCTION OF NEGATIVES. *See* TRANSPARENT POSITIVES.

RESIDUES, TREATMENT OF. *See* WASTE, REDUCTION OF.

RESIN DRY PROCESS. A dry-plate process in which the organic preservative of resin is added directly to the collodion.

RESINIZED PAPER. The substitution of resins for albumen for printing paper has been advocated. The prints, while of great beauty, are free from the defect of glossiness which is so prejudicial to the artistic character of the picture on albumenized paper. Frankinscence, 10 grains; mastic, 8 grains; calcium chloride, 5 to 10 grains; alcohol, 1 ounce. The paper is immersed in the solution, dried, and rolled. Sensitize on a sixty-grain silver nitrate bath, to the water of which has been added as much gelatine as it will bear without gelatinizing at 60° Fahr. Tone and fix with the ordinary baths.

RESINS. (*Fr.* and *Lat.*) A name given to many vegetable substances which are allied physically, although they may differ chemically. They are insoluble in water, but are generally soluble in alcohol and essential oils. They soften or melt with heat, do not crystallize, are of different shades of brown or yellow, and are of different degrees of transparency. They are of considerable value in the manufacture of varnishes.

REST. *See* HEAD REST.

RESTORING BATHS. *See* NEGATIVE, and PRINTING BATH, TO RESTORE.

RESTRAINER. A term generally used in photography to denote substances used in the developer to check its too vigorous action. For this purpose acids, gelatine, and some other organic substances are used. They prevent the developing agent from depositing silver on those parts of the sensitive film which have not been affected by light. *See* DEVELOPMENT.

RETICULATION. A network-like appearance on the collodion film. Caused by the presence of water in the collodion; too much alcohol; or too rapid immersion of the plate.

RETORT. (*Fr.*) A vessel in which a substance is placed for the purpose of submitting it to distillation.

RETOUCHING THE NEGATIVE should be only carried to the extent of removing such blemishes of the face which, though brought to view by the lens, are not ordinarily observable in the subject, as, for instance, freckles; and the softening of lines, marks, &c., more strongly marked in the portrait than in nature. Used to this extent, the process not only gives truthfulness to the picture, but adds to the beauty of the photograph in the infinite gradation of tone which in printing may be brought out. The varnished surface of the negative is abraded by rubbing over the portion to be worked upon, finely-powdered pumice-stone, or spirits of turpentine. This gives the necessary tooth for the pencil. The negative is then placed on a retouching frame in which it may be viewed by transmitted light. The light should be of the same intensity as that ordinarily used in printing; if it is weaker, the retouching marks will be too faint; if stronger, they will probably be too opaque, and cause white spots in the print from over-retouching. A HHH Faber pencil finely pointed is generally used; with this freckles, accidental spots, &c., are first worked out to the opacity of the surrounding parts. When this is done, lines and shadows may be carefully softened and the high lights and the catch light in the eyes strengthened if necessary. Accidental marks due to faults of manipulation may be toned down. The retoucher's work is thus confined within well-defined limits; the further work, which tends to

beautify, however satisfactory as a proof of power over the pencil, is false to art, and cannot too severely be censured.

RETOUCHING FRAME. A light frame glazed with ground glass, a looking glass reflector underneath illuminating the image of the negative when on the frame; above rises a hood to shut out extraneous light which would interfere with the illumination of the negative. The ground glass may well be done away with and a sheet of pure white paper substituted for the looking-glass. The negative should be masked with a sheet of brown paper in which a hole has been cut to the size of the head or part of the negative to be worked upon.

REVERSING PRISM. *See* PRISM.

RIGHT-ANGLE PRISM. *See* PRISM.

ROCK CRYSTAL. Sometimes used for lenses.

ROTTEN-STONE in a powdered state was used in the Daguerreotype process for the purpose of polishing the plates.

ROTUNDITY. *See* RELIEF.

ROUGHENING THE EDGES OF GLASS PLATES. To do away with the danger of cutting the fingers, the sharp edges of glass used for negatives should be filed off. This may be done with a file, but the best method is that of drawing the edges of two glasses together.

ROUND FRONTED CAMERA. A form of camera proposed some years ago in which the front, instead of being flat, was formed in the segment of a cylinder. It was intended to obviate the use of a swing-back.

ROUNDNESS. *See* RELIEF.

S. The chemical symbol of Sulphur.

SAL AMMONIAC. Ammonium chloride, *q.v.*

SALINE VEGETATION. *See* EFFLORESCENCE.

SALT. (*A.S.*) A term originally applied to sodium chloride, but is now applied to a mass of chemical compounds, many of which have no taste at all. A compound of any non-metal with a metal is a salt of the metal; and when spoken of collectively, the compounds of a metal with the non-metals are often called salts of that metal; *e.g.*, salts of gold, salts of silver, salts of iron, &c. The salts of one class are frequently spoken of collectively as oxides, sulphides, oxygen salts, sulphur salts, &c. *See* SODIUM CHLORIDE.

SALTED PAPER. *See* PRINTING ON PLAIN PAPER.

SALTPETRE: NITRE. *See* POTASSIUM NITRATE.

SALTS, ESSENTIAL. *See* ESSENTIAL SALTS.

SANDARACH. A resinous substance exuding from a tree of Barbary, and from the juniper tree. Usually occurs in small yellow drops, easily fusible, and soluble in alcohol. Used in varnishes.

SAND BATH. An iron bath filled with fine sand, which, heated over a stove, communicates uniform heat to the evaporating dish placed in it. *See* PRINTING BATH, TO RESTORE.

SAPONIFICATION. (*Lat.*) A term originally employed to express the decomposition of fats, under the influence of alkalies, into glycerine and a fatty acid which, uniting with the alkali, formed soap. It is now extended to all analogous actions in organic chemistry.

SATIN, PRINTING ON. *See* PRINTING ON LINEN.

SATURATION. (*Lat.*) In Chemistry, a liquid is said to be saturated with a solid, liquid, or gas which it is capable of dissolving, when it has taken up as much as possible. *See* SOLUTION. An acid is said to be saturated when a sufficient amount of base is added to it to form a neutral salt, and *vice versa* in the case of a base.

SAVING OF SILVER, ETC. *See* WASTE, REDUCTION OF.

SCREENS. In the gallery it is generally found necessary to attach movable screens or blinds to the roof and side-light to direct and subdue the light. One of the evils of a large area of glass is in the necessity for complicated and awkward blinds. The photographer may generally block up a great

portion of the light of an ordinary glass house, and so simplify the arrangements for screening the light. The best form of blinds is that of calico fixed in spring rollers, the blinds meeting in the centre of the "light."

SCRUPLE. Twenty grains Apothecaries weight.

SCULPTURE. In photographing statuary the illumination should be of the top and high side light pure, direct, and without too much diffusion to secure deep shading on the side away from the light. As a rule, a considerable amount of shadow is required. Front light is to be avoided; but the practice of illuminating from behind may often be adopted with admirable effect. Reflectors and a dark background should be provided when the work has to be done in a sculptor's atelier. A screen is often needed to reduce the illumination on some prominent part of the statue which may be too strongly lighted. The lens best adapted for the work is a single or view lens. A ripe collodion and an old, oxidized, somewhat inert developer are recommended.

SCUM on the surface of the sensitizing solution used for negatives is caused by using a too highly iodized collodion, and gives rise to little markings, like flashes, on the developed plate. The scum may be removed by skimming with blotting-paper; but as it will return with the dipping of each plate, the only cure is to add plain collodion to the collodion. Scum appearing on the printing bath should be removed with blotting-paper before floating the albumenized sheet.

SEA THONGS: SEA WRACK. *See* KELP.

SECONDARY AXIS. *See* OPTICAL CENTRE.

SECONDARY COLOURS. *See* NOMENCLATURE OF COLOURS.

SEED LAC. *See* LAC.

SEL D'OR. *See* HYPOSULPHITE OF SODA AND GOLD.

SELENITE. *See* PLASTER OF PARIS.

SENSITIZING. Rendering the film of collodion, and the surface of prepared paper, sensitive to light by immersion in, or floating upon, a solution of silver nitrate.

SENSITIZING BATH, NEGATIVE. *See* NEGATIVE BATH.

SENSITIZING BATH, POSITIVE. *See* PRINTING BATH.

SENSITIZING PAPER. The sensitizing bath should be placed lengthwise before the operator; the paper, held by two diagonal corners, in the same position. Raise the right hand slightly, and let the middle of the paper gently curve downwards. Lower the left hand over the bath, so that it is just over the centre, and draw the sheet gently towards the left hand, evenly lowering the right hand to place all the paper in contact with the solution. If the paper were placed directly on the solution, a great number of air-bubbles would be imprisoned between the paper and solution, and these would be with difficulty removed, and cause the sensitizing to be uneven. By gradually lowering the paper, and drawing it over the solution, these air-bells are driven before the paper as it falls on the solution. The time of sensitizing depends on certain circumstances, as, the strength of the bath, the temperature, the character of the paper, &c.; generally, say, from sixty to one hundred and twenty seconds. The paper should be removed from the bath by one corner, slowly. After a short draining, hang by a corner to dry.

SENSITIZING PAPER, FAILURES IN. (1.) *White round spots*, from air-bells. (2.) "*Tear drops*," the solution adheres in drops, arise from horny state of the albumen surface. (3.) *The paper repels the bath*, for the same cause; keep the paper in a cool damp room. (4.) *Grey scum*, from the surface of the bath; remove with blotting-paper. (5.) *Rapid discolouration of the paper*, from extended floating. (6.) *Sunken appearance of the image*, from the same cause. (7.) *Bronzing*, another effect of long floating. (8.) *Weak, flat pictures*, from

too short sensitizing. (9.) *Red spots and red prints*, from the same cause. (10.) "*Greasiness*" *of paper after silvering*, paper too dry before floating; not sensitized sufficiently, or the bath was too cold. (11.) *Paper curls back on the bath* because it is too dry. (12.) *Unequal prints* from unequal sensitizing. (13.) *Dark stains on the back of the paper* occur where silver has run over the back of the sheet.

SENSITIZING THE NEGATIVE. In dipping the collodionized plate into the bath it is necessary that the immersion be steady and regular. Splashes and stoppages cause stains which can never be remedied. The glass plate having been coated with collodion, and the film being set so that a finger gently impressed on the surface leaves an impression without tearing the film, the plate is placed on the dipper, and lowered into the bath steadily and without stoppage. The plate is withdrawn when the film no longer shows signs of repelling the solution, when the greasy lines which first show have disappeared. Flat sensitizing dishes are sometimes used, but they are not so convenient as the upright bath. Sensitizing the negative is effected in the emulsion processes, *q.v.*, by the use of collodion in which the silver salts have been previously dissolved, thus doing away with sensitizing as a separate operation.

SENSITIZING THE NEGATIVE, FAILURES IN. (1.) *Horizontal Lines*, "hesitation marks," are caused by stoppage of the dip. (2.) *Perpendicular lines*, sometimes by too rapid immersion. (3.) *Splashes*, by jerky manipulation. (4.) *Black streaks* springing from the portion of the glass touched by the dipper, probably from dirt. (5.) *Spear, cross, or sword-like markings*, from chemical impurities in the bath. (6.) *Pinholes*, minute white spots like sand, from an over-iodized bath. If irregular in size, shape, and occurrence, from dirt. (7.) *Fogging*, an universal veiling of the plate, is caused by alkalinity, or organic contamination of the bath. (8.) *Lack of sensitiveness*, from an over-acid or a worn-out bath. (9.) *Grey spots* are caused by scum from the surface of the bath. (10.) *Eating away of the film* indicates want of iodide. (11.) *Streaks in the direction of the dip* may be caused by the plate being sensitized before the collodion is set, or from its being withdrawn too soon. (12.) *Transparent films*, from extreme heat or cold. (13.) *Weak pictures*, probably from the bath being worn out.

SEPTUM. (*Lat.*) *See* DIALYSIS.

SERRATED. (*Lat*). Notched or indented on the edge like a saw.

SERUM. (*Lat*). The thin watery liquid which remains after the cream and cheese have been removed from milk. It contains sugar, some soluble salts, and a small quantity of uncoagulated casein; sometimes used in photography in printing on plain paper, for giving surface vigour.

SHAPE OF THE PICTURE. Although on the shape and size of a picture a great amount of its beauty depends, little or no attention appears to be given to the subject. For head and bust pictures the shape and size of the cabinet portrait is well adapted, but it is not suited to full-length figures. The carte-de-visite suits the requirements of the full-length (as far as the shape is concerned), but not of the bust portrait; yet generally their use is put to that for which they are least adapted in shape. The size of the carte-de-visite is, however, against it for standing figures, as the image is too small. A wider carte-de-visite would be admirable for the head and bust; and the lengthening of the cabinet picture would adapt it admirably to the requirements of the standing figure, and do away with the present evil of a wide blank space on either side of the figure.

"SHARPNESS." The degree of sharpness, or definition of the photographic image, most consistent with the artistic character of the portrait, is a much-vexed question, and one on which no conclusion has been arrived at. It may, however, be safely urged that the

focus being fixed on the eyes of the sitter, an ordinary portrait lens will not (unless a very small diaphragm be used) give the image too great a degree of sharpness.

SHELLAC. *See* LAC.

"SHINGLE MARKS" are generally caused by the presence of water in the collodion; also from extreme coldness of the sensitizing solution.

SHOWING THE NEGATIVE. *See* NEGATIVE, SHOWING THE.

SIDE LIGHT. In illuminating the sitter, the use of too much side light must be guarded against. For a bust picture the side light below the level of the eyes should be screened, as otherwise a blank flatness is produced on that side of the head nearest the light, and modulation is entirely lost. The effect of side light alone is to give a haggard and worn expression to the face, and a general elongation of the features.

SILK, PRINTING ON. *See* PRINTING ON LINEN.

SILVER. Ag. 107·66. Found in the native state, as well as combined with sulphur, antimony, chlorine, and bromine. It is also contained in small quantities in galena, &c. Specific gravity 10·5. Crystallizes in cubes. Melts at a heat estimated at about 1,000° Fahr.; when melted it absorbs oxygen, and just before solidifying it evolves it with effervescence, causing spirting and projection of the metal. It is extremely malleable and ductile, and has great tenacity. It is not oxidized at the ordinary temperature, and is unaffected by any atmospheric agent, except sulphur compounds, which are sometimes present. It is usually produced on a large scale by fusing its ore with a lead compound; the ore then undergoing the operation of cupellation, in which the mixture is melted in a furnace on a porous bed of bone-earth, and a blast of air blown over the surface. The lead oxidizes, and the oxide (litharge) fuses, and partly runs away and partly sinks into the porous bed of the furnace, whilst the silver remains behind in the metallic state. Another process, termed amalgamation, is sometimes employed, in which mercury is used to dissolve the metallic silver. It is also sometimes extracted in the wet state as chloride and sulphate.

SILVER ACETATE. $C_2H_3O_2Ag$. Sparingly soluble in cold water, of which it requires one hundred parts to dissolve it. Silver acetate may be prepared by adding silver nitrate to potassium acetate, both in strong solution, when silver acetate falls down as a white crystalline deposit.

SILVER ALBUMINATE. The white precipitate which falls on the addition of albumen to a solution of silver nitrate.

SILVER AMMONIO-NITRATE. A solution used as a sensitizing bath for paper in printing, prepared by adding pure ammonia to a neutral solution of silver nitrate until the precipitate which first forms is nearly dissolved, when the solution is filtered. A printing bath giving most excellent results is thus obtained. *See* PRINTING.

SILVER BATH. *See* NEGATIVE, and PRINTING BATH.

SILVER BROMIDE. AgBr. Falls as a white precipitate when silver nitrate is added to an alkaline bromide. It is soluble in ammonia and alkaline thiosulphates.

SILVER CHLORIDE. AgCl. Occurs native, when it is known as horn silver, and is precipitated as a white curdy mass when solutions of a chloride and silver are brought together. When exposed to sun or daylight, the white chloride becomes tinted of a purple colour, which increases as the action of light continues. This colouration arises from a partial decomposition of the salt, a small quantity of argentous chloride and free hydrochloric acid being formed. In presence of organic matter this change takes place much more rapidly; and upon this fact the process of silver printing is based. Silver chloride fuses at about 260°, and at higher temperature volatilizes; it is easily reduced to metallic silver in presence of zinc and sulphuric acid. The chloride is insoluble in pure water, but dissolves appreciably in strong

hydrochloric acid and in a solution of common salt. It dissolves easily in ammonia and sodium thiosulphate. For this reason the last named salt is used for fixing photographic prints.

SILVER FULMINATE. *See* FULMINIC ACID.

SILVER GLANCE. *See* SILVER SULPHIDE.

SILVER IODIDE. Ag I. Occasionally found native as Iodargyrite in hexagonal crystals of a yellowish-green colour. It may be prepared artificially by adding a soluble iodide to a solution of silver nitrate, when it falls down as an insoluble primrose-yellow precipitate, which, in the presence of silver nitrate, is coloured deep greenish-grey on exposure to light. Many reducing agents, which have no action on the iodide before its exposure to light, readily reduce it to the metallic state if it has been exposed but a few seconds to daylight. Silver iodide is insoluble in water and dilute acids, and almost so in ammonia, but it dissolves in concentrated solution of potassium iodide, in sodium thiosulphate, and in potassium cyanide.

SILVER METER. *See* ARGENTOMETER.

SILVER NITRATE. $Ag\,NO_3$. Obtained in the form of large transparent tabular crystals by evaporating a solution of silver in nitric acid, and is soluble in its own weight of cold, and half its weight of hot, water, and in four parts of alcohol. Silver nitrate fuses easily on heating, and when cast into sticks goes by the name of lunar caustic. Silver nitrate undergoes decomposition when exposed to the sunlight in contact with organic matter, and a black substance, probably consisting of the sub-oxide, is formed. The complaint against commercial recrystallized silver nitrate, sometimes raised, is fanciful generally, and the evils caused by impure silver are not nearly so serious as many would wish to believe. The cheaper silver nitrate has been used by the writer for the negative bath without any appreciable difference of result.

SILVER OXIDE. The principal oxide is the protoxide, $Ag_2\,O$, which is a dark brown powder, very slightly soluble in water, but sufficiently so to communicate to it an alkaline reaction. It is easily reduced to the metallic state by substances which absorb oxygen. Silver oxide is a powerful base, neutralizing acids, and forming with them well defined salts.

SILVER, POISONING BY, ETC. Silver nitrate is a violent caustic. Taken internally it is an irritant and very energetic poison. The best antidote is sodium chloride. A glass of water containing half a spoonful of common salt will do much to allay the effects of this dangerous poison, serving, at any rate, until medical attention can be commanded. POTASSIUM CYANIDE, the fixing solution, so much used to remove stains of silver, is one of the most violent poisons known. Easy of absorption, its action is so sudden and rapid that it is extremely difficult to arrest its action. The action of cyanide on chapped and cracked hands and cuts in the skin often gives rise to most disastrous accidents. Paralysis is a frequent consequence. The signs of poisoning by potassium cyanide are great pains about the heart, giddiness, headache, sleepiness, painful respiration, sometimes slow and sometimes fast, and interrupted by profound sighs, &c., &c. In very grave cases, general prostration is manifested with convulsions. The phenomena come with awful rapidity, and death ensues in a syncope. Even where a cure is effected, nervous affections afflict the patient for a considerable time afterwards. If the poisoning is communicated through cut or chapped hands, the first thing to be done is to wash the wound in water saturated with chlorine at the ordinary temperature, and at the same time drink thirty or forty grains of chloride in a glass of water. The patient should then be placed in bed or on a sofa, warmly covered, hot water bottles placed at his feet and along the whole length of his body. Plenty of air should be admitted to the room, while the patient is kept very warm by coverings. Tea or coffee with ten drops of

laudanum and one or two teaspoonsful of brandy administered. This should be repeated three or four times at intervals of a quarter of an hour. Every five minutes give one teaspoonful of the following mixture:—Chlorine water, 5 parts; chloro-hydrate of ammonia, 2 parts; sugar water, 250 parts. Ammonia may also be found of service. Let the patient inhale the vapour of ammonia, and drink fifteen or twenty drops in a glass of water. It should be borne in mind that delay of a minute or even a second may render antidotes of no avail, so energetic is the action of this poison. POTASSIUM DICHROMATE has also a deleterious influence on the health. Pustules, ulcerations, and other wounds are caused by it, and the fine powder inhaled gives rise to inflammation of the mouth, the eyes, &c., and obstinate colds, developing into a characteristic lesion. Taken internally, it is an irritant and violent poison, characterised by inflammation, and sometimes cauterisation of the mucous membrane of the mouth, throat, and stomach. Painful cramps and vomiting indicate its presence in the system, chilliness of the hands and feet, diarrhœa, and choleraic symptoms. Intoxication, paralysis of the limbs, ensue until death supervenes. To counteract its influence administer a dose of lime water mixed with albumen. Restore warmth to the limbs by friction, using as an embrocation alcohol, 100 parts; ammonia, 5 parts. BICHLORIDE OF MERCURY *or Corrosive Sublimate* produces gangrene when brought into contact with broken skin. Absorbed into the system it causes abnormal secretion of the saliva, with softening and ulceration of the gums. Chlorate of potash dissolved in water serves as a wash or for gargling, or may be drunk to prevent salivation and its attendant ills. Corrosive sublimate taken internally gives rise to inflammation of the mucous membrane, blood vomiting, &c. The best antidote is albumen mixed with sugared water or honey. Iron or zinc filings mixed in honey are also serviceable.

SILVER RESIDUES. *See* WASTE, REDUCTION OF.

SILVER STAINS, ETC. Hydrochloric acid diluted to half its strength, or chloride of lime in strong solution. Rub well over the hands until the stains disappear—the iron stains may still remain of a greenish tint. Rinse the hands and apply a little of a dilute solution of potassium oxalate. The application of tincture of iodine, and afterwards a little potassium cyanide, is also effective. The stains of alkaline development may be removed by oxalic acid.

SILVER SULPHATE. $Ag_2\,SO_4$. A white salt formed by the dissolution of silver in its own weight of boiling sulphuric acid; or by adding sodium sulphate to a solution of silver nitrate. It is soluble in ninety parts of cold water.

SILVER SULPHIDE. Ag_2S. Occurs native in cubic crystals, as silver glance; it is precipitated as a black powder by passing sulphuretted hydrogen through solutions of salts of silver. Insoluble in the ordinary solvents of silver, but soluble in nitric acid. When sulphide of silver is found in silver films, its colour depends on the quantity present; in the texture of the print it is brown and in patches; on the surface of prints, either yellow or dark brown; and when in mass it is black. Silver sulphide is a most destructive agent to photographic prints.

SITTERS, HINTS ON TREATMENT OF. The operator who comes in contact with the patrons of the gallery should possess the qualities of gentleness and good humour, which may withstand the test of much provocation. Generally the cause of annoyance is far removed from the sitter on whom anger may be vented. The time of sitters waiting their turn for sitting should be respected, and no long trial of their patience made. If unavoidable delay arise they should be informed of it, and opportunity given them to seek a more convenient day. Chemicals, plates, &c., should be in readiness for a sitting. Pose quickly, and do not worry the sitter by many changes of position—the most suitable

pose should be no matter of uncertainty in the mind of the operator. Never lose temper over the (supposed) crotchets of customers, but try to carry out an expressed wish to the best advantage. Do not be angry if your best pictures are rejected, or rude if the worst give pleasure.

SIZE OF THE PICTURE. *See* SHAPE OF THE PICTURE.

SKYLIGHT. *See* GLASS HOUSE.

SLIDE, DARK. *See* PLATE HOLDER.

SLIPPING OF THE FILM, in washing the negative after washing or fixing, is due to the greasiness of the glass plate. This awkward accident will never happen if the plate is albumenized, and the collodion poured on the proper side of the glass. *See* ALBUMENIZING GLASS PLATES.

Sn. The chemical symbol of Tin (Stannum).

SODA, BICARBONATE OF; OR, HYDROGEN SODIUM CARBONATE. $HNaCO_3$. Obtained by exposing the crystallized carbonate in an atmosphere of carbonic acid gas. It is a white crystallic powder, which, on heating, is readily converted into sodium carbonate.

SODA, HYPOSULPHITE OF. *See* SODIUM THIOSULPHATE.

SODIUM, ACETATE. $C_2H_3O_2Na$. An efflorescent crystalline salt, prepared by saturating acetic acid with sodium carbonate.

SODIUM CARBONATE. Na_2CO_3. Ordinarily known as soda. In the pure crystallized state it forms diagonal prisms, containing ten atoms of water, which effervesce in dry air. In the anhydrous state it is a white powder, fusing at a moderate red heat. Both the crystals and the anhydrous salt dissolve readily in water, and form a highly alkaline solution.

SODIUM CHLORIDE. NaCl. Common salt. From this salt almost all the other sodium compounds are formed. It occurs in thick beds in various parts of the world, and is also prepared from sea water. Soluble in two and a-half parts of water at 15°, and does not dissolve sensibly more in hot than in cold water. Useful in photography for precipitating silver from solutions. *See* WASTE, REDUCTION OF.

SODIUM HYPOSULPHITE. *See* SODIUM THIOSULPHATE.

SODIUM NITRATE. $NaNO_3$. Found in large beds in Peru and Northern Chili, and termed soda, or Chili-saltpetre. Used in the preparation of nitric acid (being cheaper than nitre) and of nitre.

SODIUM THIOSULPHATE. $Na_2S_2O_3 + 5H_2O$. This useful salt, commonly known as hyposulphite of soda, is prepared by passing a current of sulphur dioxide into a mixed solution of sodium sulphide and caustic soda, and purifying by crystallization the sodium thiosulphate is obtained. It is largely used for the purpose of fixing the photographic image, the salt possessing the property of dissolving the silver salts which have not been acted upon by light. *See* FIXING NEGATIVES and PRINTS.

SOLAR CAMERA. A camera for the production of enlarged prints. *See* PRINTING IN THE SOLAR CAMERA.

SOLARIZATION. A peculiar effect seen on over-exposure to light of a sensitive film of silver iodide, which is exhibited in a blueness of the over-exposed parts of the picture.

SOLID (*Lat.* and *Fr.*) A body whose parts are so connected together as not to slip away from each other on the smallest pressure: opposed to fluid.

SOLIDIFICATION is the passage of bodies from the liquid to the solid state. The process is the reverse of that known as fusion. It is accompanied by evolution of heat and in general by change of volume. Two principal laws govern the phenomenon: first, each substance solidifies at a fixed temperature if the pressure upon it is always the same; that temperature is the temperature of fusion for the body; second, from the commencement to the close of the process the temperature of the liquid remains at this fixed point.

SOLUBLE (*Lat.*) Capable of dissolution, or separation of parts.

SOLUBLE GLASS. A name sometimes applied to potassium dichromate.

SOLUTION (*Fr.* and *Lat.*) When a liquid adheres to a solid with sufficient force to overcome its cohesion, the solid is said to undergo solution, or be dissolved. Thus water dissolves salt; spirits of wine resin, &c. By diminishing cohesion in the solid, as by reducing it to powder, solution is facilitated in consequence of the larger amount of surface exposed to the action of the solvent. Heat also, by diminishing cohesion, favours solution. The first portions of solid added to the liquid may disappear quickly, but as fresh portions are added solution goes on more and more slowly, until it ceases altogether. In such cases the forces of adhesion and cohesion balance each other, and the liquid is said to be saturated.

SOLVENT (*Lat.*) Having the power to cause dissolution.

SPECIFIC GRAVITY is the number expressing the ratio between the weight of any volume of a substance, and the weight of an equal volume of any standard substance. In the case of solids and liquids the standard substance is water; in that of gases and vapours it is usually hydrogen, sometimes atmospheric air.

SPECTRAL COLOURS. The colours of the spectrum, *q. v.*

SPECTROSCOPE (*Gr.*) Instrument for the observation of the spectra, and the measurement of the lines present.

SPECTRUM (*Lat.*) Display of prismatic colours, resulting from the decomposition of light. When a ray of white light falls upon a prism it is refracted, and at the same time dispersed, its component colours being spread out, forming the spectrum of the light. By passing the light, in the first place, through a very narrow slit, from one-hundredth to one-thousandth of an inch wide, and then letting it pass through several prisms and lenses, the spectrum may be obtained of a high degree of purity—that is, the different coloured images of the slit are arranged side by side in the order of their refrangibility without overlapping each other, even in some cases showing blank spaces between them. The spectrum may be considered to be divided into seven colours—red, orange, yellow, green, blue, indigo, and violet; but no sharp line of distinction can be observed between any of these colours, as they shade into one another through infinite gradations.

SPECTRUM, CHEMICAL ACTION OF. When a solar spectrum of considerable purity is allowed to fall on a sensitive photographic plate containing silver iodide, no effect is produced by the ultra-red, the red, orange, green, or blue rays; the action commences at about the fixed line G, and continues under favourable circumstances of atmospheric transparency to a distance exceeding by about seven times the visible limits of the solar spectrum. This photographic impression is seen to be furrowed across by a great number of lines of all degrees of width, sharpness, and intensity, showing that the fixed lines of the spectrum are not confined to the visible portion. There is no sharp distinction between these actinic rays and the visible portion; in fact, the violet and indigo may be considered both light and actinism, in the same way as the extreme red may be considered as light and heat. Although, therefore, the term actinism (*q. v.*) is not accurate, as applied to a portion of the spectrum, it is a very convenient expression for a property of that portion.

SPHERICAL ABERRATION. *See* ABERRATION, SPHERICAL.

SPIRITS OF WINE. *See* ALCOHOL.

STAINING THE FILM is sometimes resorted to for the prevention of blurring; but the plan of backing the plate is generally to be preferred.

STAINS on the hands, caused by silver nitrate, may be speedily removed by first rubbing over them tincture of iodine, and then a solution of potassium cyanide. The hands should be thoroughly washed afterwards.

STANNOUS; STANNIC (*Lat.*) Salts of tin.

STARCH. $C_6H_{10}O_5$ (or some multiple of these numbers). This important substance exists most widely diffused throughout the vegetable world. It consists of a white powder composed of granules which have a distinctly organised structure, and are of various sizes. Starch granules are insoluble in cold water, alcohol, and ether, but when heated with water above 60° they swell up and split open, forming a thick paste called starch paste. If this paste be boiled with a larger quantity of water the particles of starch become so finely divided that they pass through a filter, and with further boiling the solution becomes clear, and the starch is rendered soluble.

STARCH PASTE for mounting prints is prepared by mixing the starch to a paste in cold water, and pouring over it boiling water, until the paste swells; dilute to the required consistency by addition of boiling water. Starch paste should be used perfectly fresh. It may be preserved from getting sour by the addition of a few drops of essence of cloves.

STEREOSCOPE (*Gr.*) An instrument in which two photographs or pictures, almost though not quite alike, are viewed to produce the appearance of solidity. Each picture is what one eye would see if looking at the object pictured, so that the two together present the semblance of roundness.

STEREOSCOPIC CAMERA. A camera fitted with two lenses of uniform focus for taking two views of the same object side by side on one plate. In mounting the prints obtained from this negative, the position of the pictures is reversed. Where a large number of prints are required it is a good plan to cut the glass in the centre, and reverse the pictures, and cement them to a clean piece of glass, by which the necessity for cutting each print is obviated.

STEREOSCOPIC EFFECT in portraiture; a term used to express great rotundity of the image. The excess of roundness is inartistic, calculated only to cheat the ignorant of their admiration. *See* RELIEF.

STEREOTYPE (*Gr.*) A metal plate from which to print in the press. *See* MECHANICAL PROCESSES.

STOP. *See* DIAPHRAGM.

STOVE, DRYING. *See* DRYING OVEN.

STREAKS on the negative may be caused in various ways. In the bath, by the immersion of the plate before the collodion has set, or from the film setting too much. Too rapid immersion of the plate also causes streaks. From impurities in the bath. In developing, from faulty manipulation; too much alcohol in the developer; too little, &c. *See* FAILURES IN SENSITISING, and DEVELOPMENT.

STRIPPING THE FILM. *See* FILM STRIPPING.

SUBLIMATION. A kind of distillation when the substance submitted to heat rises in vapour, and condenses, not as liquid, but as a solid, either crystalline or pulverulent. The product is called a sublimate; thus sulphur forms a sublimate known as flowers of sulphur.

SUBLITIZE. Make thin: to refine.

SUBSALT. A salt with less acid than is sufficient to neutralize its radical.

SUBSTITUTE FOR GROUND GLASS. *See* GROUND GLASS.

SUBSTRATUM (*Lat.*) A layer of any substance, serving as a basis or foundation. Used in photography to express a film of albumen, gelatine, &c., employed to hold the coating of collodion on the glass plate to secure perfect adhesion.

SUGAR OF LEAD. *See* LEAD ACETATE.

SUGGESTION; in Art, the power of leading the mind of the spectator to a higher state of imagination through the picture. Beyond the well telling of the story, a picture should awaken a train of thought, pleasant, far-reaching, and ennobling.

SULPHATES. Combinations of sulphuric acid and bases.

SULPHITES. Combinations of sulphurous acid with bases

SULPHO-CYANIDES. Compounds of sulpho-cyanic acid with bases, or sulpho-cyanogen with metals.

SULPHUR (*Lat.*) S 31·98. Occurs both free and combined in nature. Sulphur exists in three modifications; the first is that in which it crystallizes in nature, and the other two are obtained by melting sulphur. If melted sulphur be allowed to cool slowly, it crystallizes in long, transparent, needle-shaped, prismatic crystals, which are quite different in form from the natural crystals, and have the specific gravity of 1·98, whereas the specific gravity of the crystals of native sulphur is 2·07. These transparent crystals become opaque on exposure to the air for a few days. The third allotropic modification of sulphur is obtained by pouring melted sulphur, heated to 230°, into cold water; the sulphur thus forms a soft tenacious mass resembling caoutchouc, with a specific gravity of 1·96. This mass in a few hours becomes brittle. Sulphur is an inflammable substance, and when heated in the air, or in oxygen, burns with a bluish flame. Sulphur combines with chlorine, carbon, and most other elements. It is insoluble in water and most organic liquids, but both the natural octahedral variety and the crystalline or prismatic variety dissolve freely in carbon disulphide, CS_2, and when deposited it crystallizes in the ordinary natural or octahedral form.

SULPHUR, ACTION OF, ON PRINTS. *See* FADING.

SULPHURET OF POTASSIUM. *See* POTASSIUM SULPHURET.

SULPHURETTED HYDROGEN. *See* HYDROGEN SULPHIDE.

SULPHURIC ACID, OR HYDROGEN SULPHATE. H_2SO_4. 79·82. The most important and useful acid known, as by its means nearly all the other acids are prepared, and because of its extensive use for a variety of purposes, in the arts and manufactures. In photography the principal use of sulphuric acid is in the manufacture of pyroxyline. It is also used as an etching fluid in photo-zincography; for cleaning glass plates, &c.

SULPHUR TONING. *See* TONING BATH.

SUPERPHOSPHATE OF LIME. *See* PHOSPHOROUS.

SUPERSATURATION. A liquid is said to be supersaturated when being saturated at a high temperature it can be cooled down without depositing any of the solid. At this reduced temperature, then, the liquid holds more of the solid than it could take up or dissolve at that reduced temperature.

SUPPLEMENTARY LIGHTING. For negatives, the exposure of which in the camera is necessarily short, as, for instance, in the case of children, the exposure of the negative to diffused light has been recommended. The plate, before development, is held near the yellow glass window of the dark room for half a minute. Circumstances may, of course, render this treatment of service, but the effect of supplementary lighting of this kind can only be to fog the plate.

SWING-BACK. An arrangement of the camera back so that when it is tilted the ground-glass may be fixed in a perpendicular position; or in the practice of the studio to regulate it to secure focus at any important part of the picture.

SYLVINE. *See* POTASSIUM CHLORIDE.

SYMBOL (*Lat.* and *Gr.*) A chemical symbol represents an element and a definite quantity by weight in which that element can unite with others. In writing symbols these numbers are not expressed after the symbol, but are understood. *See* FORMULÆ.

SYMMETRY (*Gr.*) Adaptation of parts to each other: proportion: harmony: agreement of one part to another.

SYNTHESIS (*Gr.*) The production of a compound by combining—*i.e.*, bringing in contact, and causing to unite chemically—its several components.

TABLE OF ELEMENTS. *See* VOCABULARY.

TALBOTYPE. *See* CALOTYPE.

TANGENT (*Lat.*) Right line which touches a curve, but does not cut it when produced.

TANNIN, OR TANNIC ACID. $C_{27}H_2O_{17}$. This substance is contained widely diffused in certain parts of plants. It is distinguished by forming an insoluble compound with gelatine, and by producing a black colour with ferric compounds. Tannic acid occurs in largest quantities in gall-nuts; it is extracted by aqueous ether from the powdered gall-nuts. Thus prepared, tannin is an uncrystallizable mass, soluble in water and alcohol, but insoluble in pure ether. Tannin forms glucose and gallic acid when it is exposed to the air, or when treated by dilute acids. Heated to 215° it yields pyrogallic acid.

TANNIN PROCESS. *See* DRY PLATE PROCESSES.

TARTARIC ACID, $C_6H_6O_6$, exists in the juice of many fruits, and is deposited as potassium salt during the fermentation of wine, and this salt is known as tartar. Tartaric acid is also formed by the action of nitric acid on sugar of milk.

TEA PROCESS. *See* DRY PROCESSES.

TENACITY (*Fr.* and *Lat.*) The property by which solids resist forces tending to separate their particles from one another.

TENT. *See* DARK TENT.

TERTIARY COLOURS. *See* NOMENCLATURE OF COLOURS.

TEST (*Lat.* and *Fr.*) A term applied to any substance which serves to detect the presence of a poisonous ingredient in a composition.

TESTING THE CAMERA. *See* CAMERA.

TESTING THE FOCUS OF LENS. *See* ACTINIC FOCUS.

TEST PAPERS. Litmus papers, as usually supplied to photographers, are made up in little long narrow books. Blotting-paper is steeped in an infusion of litmus. Blue litmus paper is a test for acidity. By dipping it in very dilute sulphuric acid and drying it, a test is obtained for alkalinity. Another test for alkalinity is made by steeping blotting-paper in an infusion of turmeric; this is of a yellow colour, and is changed to brown in presence of an alkali. Test papers should be used and kept with care. In photography, where generally but a slight acidity or alkalinity is required in a solution, a minute or two should be allowed for change of colour.

THERMOMETER (*Gr.*) The instrument most used in the present day for the indication of temperature is the mercurial thermometer, the construction of which depends on the fact that mercury increases in volume under the action of heat to a much greater extent than glass. If, therefore, we have a volume of mercury in a closed glass envelope, and in connection with a capillary tube, we are able to appreciate a variation of temperature by the position of the column of mercury in the tube, certain fixed positions being given and established. In order to acquire some idea of the degree of change of temperature, it is necessary to graduate the thermometer tube—that is, to divide it into a number of equal parts; and for this purpose it is essential that we have two fixed points or limits of temperature. These are found in the freezing and boiling points of water. In the Fahrenheit scale, the freezing point is marked 32°; Celsius and Reaumur, 0°; and in the almost obsolete scale of Delisle, 150°. The upper fixed point is in the Fahrenheit scale, 180°; Celsius, 100°; Reaumur, 80°; and Delisle, zero or 0°.

THINNESS OF NEGATIVE. Generally caused by over-acidity of the chemicals.

TINCTURE OF IODINE. The alcoholic solution of iodine, *q.v.*

TISSUE, CARBON. *See* CARBON TISSUE.

TOBACCO PRESERVATIVE has been used with considerable success; it is prepared as follows:—Tobacco, 20 grains; gum-arabic, 10 grains; water, 1 ounce. Boil the tobacco, fil-

ter, and dissolve the gum in the filtrate.

TONING. This operation is resorted to for the purpose of giving to the print a more agreeable colour than would result if it were after printing placed at once in the fixing bath; and to vary the tone as occasion may call for. When the printing for the time is completed, the prints are placed in a dish of water, and washed in two or three changes of water; then, with one hand, they are, one by one, dropped on the surface of the toning solution, and immersed, care being taken not to allow the toning solution to have access to the print before it is placed in the bath, or spots and stains are sure to result. For this reason the manipulator removes the prints from the water, and drops them into the toning bath with one hand, and with the other gently, but speedily, submerges them. The tone of the prints should bear a definite relation to the character of the picture. Prints from one negative should, of course, all be toned alike; but toning may be very even, yet still very bad. The operation of toning is one that calls for a considerable amount of taste. With a number of prints in the bath, care must be exercised to prevent unequal toning. Keeping the prints in constant motion, continual care and watchfulness over each print are necessary. With most toning baths it is necessary only to continue the operation a shade beyond the point where the print has assumed the required tone; it is then removed and placed face downwards in a dish of pure water. In the toning bath rapidity is gained by placing the print face downwards. This treatment, with the use of a strong bath, is required for prints from a very intense negative; vigorous toning tending to reduce the intensity of the print. *See* TONING BATH.

TONING BATH. Very many formulæ are in use, most of which are sufficiently serviceable for ordinary work. The best, perhaps, for facility of preparation, easy management, evenness, as well as beauty of result, and in the length of time it will keep in working order, is prepared as follows:—Sodium acetate, 75 grains; gold chloride, 3 grains; water, 30 ounces. This bath, though, when quite new, may not be satisfactory, develops after two or three days' use into a splendid toning solution. Addition of the gold chloride, previously dissolved in water, should be made ten or twelve hours before the bath is required for use—1 grain of gold being added each time will be sufficient to tone, say, two sheets of paper. The bath should be filtered each time after use. Sodium acetate is added as occasion calls for. CARBONATE OF SODA BATH.—With this bath, the prints being somewhat bleached, rather deeper printing is required. Sodium carbonate, 45 grains; gold chloride, 3 grains; water, 30 ounces. Fresh solution is made up each time, about an hour before it is required for use. The purple shade of the half-tones may be taken, roughly speaking, as the signal for removing the prints. CHLORIDE OF LIME BATH, especially adapted for prints of subjects in black-and-white, as line engravings, maps, plans, &c. Lime chloride, 4 grains; gold chloride, 3 grains; water, 30 ounces. This bath, by the addition of sufficient gold and a little lime, may be used over and over again, if the clear liquid in the stock-bottle be decanted carefully when required for use. CITRIC ACID BATH.—Prepare two stock solutions. No. 1. Citric acid, 1 ounce in 20 ounces of water; No. 2. Gold chloride, 15 grains in 15 ounces of water. Take of No. 1, 3 ounces; ½-ounce of No. 2, made slightly alkaline with bicarbonate of soda immediately before addition; water, 30 ounces. SULPHOCYANIDE BATH.—This may be used soon after it is made. Sulphocyanide of ammonium, 20 grains; gold chloride, 1 grain; water, 30 ounces. On immersion the prints are reduced to a reddish hue, but after a short time assume warm, brilliant tones, and on extension of the action, a rich black. SULPHUR BATH.

By a discarded usage prints have been toned and fixed by the same bath, that is to say, by addition of gold chloride to the ordinary fixing bath of hyposulphite of soda. On the unchanged silver salts dissolving out the image was of the usual red colour, but the action being a short time carried further this tone changed to blue and black; the toning was then deemed complete. The extreme instability of prints toned by this process, which at first sight appears such an attractive and perfect method, led to its being discarded.

CARBONATE OF LIME BATH.—Keep the gold in solution, one grain to the drachm of water. To make up the bath mix two grains of lime carbonate into a paste with one drachm of the gold solution; add four or five ounces of water, and when the solution is colourless, it is ready for use.

TOP LIGHT, EFFECT OF. The effect the use of top light alone or in excess gives, is to render the shadows cast under the eyes, nose, upper lip, chin, &c., heavy and coarse. A brutal, beetle-browed expression is given to the face, and a very inartistic and unpleasant picture is the result.

TOURNCOOL. *See* LITMUS.

TRACING PAPER. Semi-transparent paper on which may be made the tracing of a picture placed underneath. Often of considerable use in photography for a retouching surface, or for working up artistic effects.

TRAGACANTH, GUM. *See* GUM TRAGACANTH.

TRANSFER OF NEGATIVE TO A POSITIVE. Pour over the varnished negative a thin solution of gelatine and potassium dichromate. Expose, and develop by means of hot water, when the bichromated gelatine will be found to adhere to the clear portions of the glass. Treat the image thus obtained alternately with uranium and prussiate of potash until it assumes a reddish tint; then apply an ordinary pyrogallic acid solution which renders the film of a deep red-brown colour, quite impervious to light rays.

TRANSFER PAPER, CARBON. *See* CARBON TRANSFER PAPER.

TRANSFERRING. A lithographic process adopted in the photo-lithographic processes. *See* MECHANICAL PROCESSES.

TRANSLUCENT (*Lat.*) A term by which is designated the power of transmitting rays of light, but not so as to render objects distinctly visible.

TRANSPARENCY (*Lat.*) That property of a body which allows rays of light to pass through it. It is the opposite to opacity, and, like this term, is sometimes extended to the whole spectrum. Thus we speak of a solution of iodine in carbon bisulphite as being transparent to heat, and of rock-crystal as being transparent to the actinic rays.

TRANSPARENT POSITIVES may be produced in several ways, by the wet and dry processes; in the printing-frame, and in the camera. The negative most suitable for the production of transparent pictures is one thin, full of detail, and with the shadows of clear glass—unvarnished. When the positive is to be made in the camera, a box, open at both ends, is provided; at one end the negative is placed, and all extraneous light blocked out; at the other end the camera is inserted. The negative is directed to a clear portion of the sky, and the focussing should be made with the nicest exactitude. Exposure full. A wet plate may be used in the printing frame by placing between it and the negative strips of cardboard at the edges to prevent actual contact. The developer is prepared with a large excess of acetic acid. Fix with potassium cyanide. The positives may be toned with the ordinary solution if any special tint is desired. With dry plates great facility is afforded for the production of transparent positives, the treatment being the same as for negatives.

TREACLE. The thin light-coloured treacle known as golden syrup is sometimes used as a preservative in dry plate photography.

TRIMMING PRINTS. *See* CUTTING PRINTS.

TRINITRIN, TRINITROGLYCERIN. *See* GLYCERIN.

TRIPLET. A form of lens.

TRIPOLI. A siliceous stone composed of remains of microscopic plants; sometimes used for polishing plates.

TRITURATION (*Lat.*) Reduction of any substance to powder upon a stone with a muller, as colours are ground. Also called levigation.

TROY WEIGHT. *See* WEIGHTS AND MEASURES.

TURNSOLE. *See* LITMUS.

U. The chemical symbol of Uranium.

UNDER-EXPOSURE, EFFECT OF. The image appears reluctantly, the lightest portions only appearing, and these without any graduation, the shadows being bare except for the fogging of the plate caused by the forcing of the development.

UNDULATORY THEORY OF LIGHT. The theory of light generally adopted at the present day. It presupposes the existence of a universal ethereal medium, infinitely elastic and subtle, pervading all space. The sensation of light is occasioned by rapid oscillations, vibrations, or waves in this imponderable ether. The analogy which exists between the phenomena of light and sound, as well as the remarkable concordance between the observed phenomena of light and those predicted by mathematical investigations, render it in the highest degree probable that the undulatory theory of light is very near the true one.

URANIUM. U·240. Uranium is a metal which occurs but sparingly in nature, existing combined in two somewhat rare minerals, pitchblende, and uranite. The metal is of a steel white colour, and it does not oxidize in dry air at ordinary temperatures, but when strongly heated it burns brilliantly. There are two oxides which form salts, viz., uranous oxide, UO_2, and uranic oxide UO_3: the uranic compounds are yellow. The sulphide is an insoluble salt of a yellowish-brown colour.

URANIUM NITRATE. *See* URANYL NITRATE.

URANIUM PRINTING PROCESS. A sheet of paper rendered sensitive to light by immersion in a strong solution of uranium nitrate, and dried, is exposed under a negative, a very faint image being obtained, seen by holding the picture up to the light. The print is then placed either in a weak solution of gold chloride, by which a purple tint is obtained; or in a strong solution of aceto-nitrate of silver, which gives a chocolate-brown picture. The print is then well washed. The chief objections to the process were found in the difficulty of obtaining good surface vigour and fine definition. Herr Wothly claimed to have overcome them by his process. *See* WOTHLYTYPE.

URANIUM PROCESS. *See* EMULSION PROCESSES.

URANYL NITRATE $UO_2(NO_3)_2+6H_2O$ is prepared by dissolving any of the oxides of uranium in nitric acid. It crystallises in fine lemon-yellow fluorescent rhombic prisms, which are soluble in half their weight of water, and deliquesce on exposure.

USED GLASS, TREATMENT OF. *See* GLASS PLATES, CLEANING.

VACUUM (*Lat.*) Space unoccupied by matter.

VANDERWEYDE LIGHT. *See* ARTIFICIAL LIGHT.

VAPORIZATION (*Lat.* and *Fr.*) The change from the liquid to the gaseous condition of matter. This may take place according to two principal modes, the first of which, evaporation, is the formation of vapour at the surface of a liquid, without the production of bubbles of vapour, and unaccompanied by perturbation of the liquid; the second, ebullition, is the formation of vapour within the mass of a liquid, accompanied by the production of bubbles of vapour, and by a consequent perturbation of the liquid.

VAPOUR ON LENS. *See* DEW POINT.

VAPOURS IN THE DARK ROOM, &c. Many of the photographic chemi-

cals are extremely volatile—as, for instance, alcohol and ether—and their effect on the system cannot in any case be beneficial; in some instances their influence is positively hurtful to the health. Potassium cyanide should be kept in upright baths, and care taken not to inhale any of its vapour. Ventilation of the dark-room should be studied; and the worker should, for the sake of his health, indulge in a long walk in fresh air on the conclusion of his day's work.

VARNISH. Resin or gum dissolved in spirit, used for the protection of the collodion film. The most common solvent used in the manufacture of varnishes is methylated spirits, absolute alcohol not being suitable, as it will destroy the image by dissolving the pyroxyline of the collodion. A good negative varnish may be made by keeping a stock bottle of fine shellac in methylated spirits. Decant as required for use, and dilute. To this, if the film does not prove tough enough, ten per cent. of sandarac may be added. An amber varnish may be made by fusing the amber in a covered dish, and dissolving in benzine or in chloroform. Copal varnish.—1 part of copal in 2 parts of benzine. Yellow varnish, for retarding the action of the light in printing, is made by adding 1 part of iodine to 100 parts of varnish. Red varnish: 1 part of dragon's blood to 100 parts of varnish; but this often bleaches in the light. These coloured varnishes should be applied to the glass side of the negative. Black varnish.—Asphaltum, ½ ounce; Canada balsam, 1 ounce; oil of turpentine, 10 ounces;—or, asphaltum, ½ ounce; india-rubber, ¼ drachm; benzole, 15 ounces.

VARNISHING THE NEGATIVE. The plate should be gently warmed, and the varnish poured over the surface in the same manner as the plate is coated with collodion. Pour back the surplus varnish into a filtering bottle, gently rock the plate to prevent the film setting in ridges, and return the plate to the drying stove. The varnish film generally is not ready for retouching, *q.v.*, until after twenty or twenty-four hours. A proof print may, however, be taken directly the varnish film has thoroughly cooled.

VEGETABLE IVORY. *See* IVORY, VETEGABLE.

VENTILATION of every part of the studio should be secured for the preservation of health. The vapours from the chemicals are extremely trying to the health of many persons, and are, at all events, a source of discomfort.

VIGNETTE (*Fr.*) A term applied to pictures having no complete background or bounding line.

VIGNETTE FERROTYPE. The image of a sitter may be vignetted by placing a card from which the segment of a circle has been cut, and the edge serrated, between the sitter and the lens. This card, which is placed on a stand, is placed out of focus, so that the image on the ground glass appears gradually to melt into the white background as in a vignetted engraving. With a grey background the vignetter may be shaded to the tone of the background by turning the vignetting apparatus more or less away from the light, instead of, as in the case of a white vignette, directly in the light.

VIGNETTE GREY. A vignette in which the background is darkened or greyed. *See* PRINTING VIGNETTES.

VIGNETTE OVALS. Vignette prints in which the action of the light is stopped by an oval cut-out.

VIGNETTING. *See* PRINTING VIGNETTES.

VIRTUAL FOCUS. *See* FOCUS.

VIRTUAL IMAGE. An image without material existence; in effect, though not in fact.

VISION, BINOCULAR. *See* BINOCULAR VISION.

VISION, MONOCULAR. *See* MONOCULAR VISION.

VISUAL FOCUS. *See* FOCUS.

VISUAL POINT. In perspective, a point in the horizontal line, in which all the ocular rays unite.

VISUAL RAYS. Lines of light

supposed to come from the object to the eye.

VIVIFACTION (*Lat.* and *Fr.*) In chemistry, the act of giving new lustre, force, and vigour.

VOCABULARY. Aluminium (Al) 27·3. Antimony (Sb) 122·0. Arsenic (As) 74·9. Barium (Ba) 136·8. Beryllium (Be) 9·0. Bismuth (Bi) 210·0. Boron (B) 11·0. Bromine (Br) 79·75. Cadmium (Cd) 111·6. Caesium (Cs) 133·0. Calcium (Ca) 39·9. Carbon (C) 11·97. Cerium (Ce) 141·2. Chlorine (Cl) 35·37. Chromium (Cr) 52·4. Cobalt (Co) 58·6. Copper (Cu) 63·0. Didymium (D) 147·0. Erbium (E) 169·0. Fluorine (F) 19·1. Gallium (G) —. Gold (Au) 196·2. Hydrogen (H) 1·0. Indium (In) 133·4. Iodine (I) 126·53. Iridium (Ir) 196·7. Iron (Fe) 55·9. Lanthanum (La) 139·0. Lead (Pb) 206·4. Lithium (Li) 7·01. Magnesium (Mg) 23·94. Manganese (Mn) 54·8. Mercury (Hg) 199·8. Molybdenum (Mo) 95·6. Nickel (Ni) 58·6. Niobium (Nb) 94·0. Nitrogen (N) 14·01. Osmium (Os) 198·6. Oxygen (O) 15·96. Palladium (Pd) 106·2. Phosphorus (P) 30·96. Platinum (Pt) 196·7. Potassium (K) 39·04. Rhodium (Rh) 104·1. Rubidium (Rb) 85·2. Ruthenium (Ru) 103·5. Selenium (Se) 78·0. Silver (Ag) 107·66. Silicon (Si) 28·0. Sodium (Na) 22·99. Strontium (Sr) 87·2, Sulphur (S) 31·98. Tantalum (Ta) 182·0. Tellurium (Te) 128·0. Thallium (Tl) 203·6. Thorium (Th) 231·5. Tin (Sn) 117·8. Titanium (Ti) 48·0. Tungsten (W) 184·0. Uranium (U) 240·0. Vanadium (V) 51·2. Yttrium (Y) 93·0. Zinc (Zn) 64·9. Zirconium (Zr) 90·0.

VOLATILE ALKALI. *See* AMMONIA.

VOLUME (*Fr.* and *Lat.*) A term applied in chemistry to the comparative measurement of the bulk or space occupied by known weights of different gases; also to the alteration in size of any known quantity of a gas under change of circumstances.

VOLUMETRIC ANALYSIS. *See* QUANTITATIVE ANALYSIS.

VOLUMETRIC CONDENSATION. When gases chemically combine with one another, they frequently condense during the process, and produce less gas after combination than the quantities originally taken.

WASHED EMULSION. *See* EMULSION PROCESSES.

WASHED PAPER. For the preservation of sensitized paper for several days the plan has been adopted of passing it through two or three changes of water, before drying. The paper should not be soaked, as the free silver should not entirely be eliminated. *See* PRESERVED SENSITIZED PAPER.

WASHING DRY PLATES. Dry plates prepared in the bath, and with some kinds of emulsion, are washed in distilled or purified water. For this purpose two dipping baths are filled with water, and into one of these the plate is dipped, care being taken that there is no stoppage in the immersion. The plate is left in the first bath until all greasiness has disappeared from its surface, when it is placed in the other bath of water and there left for four or five minutes. It is then washed under the tap for a few seconds and rinsed with distilled water, when it is ready for coating with the preservative, *q.v.*

WASHING WET PLATES. Sometimes, for long exposures, the plate is dipped in slightly acid distilled water, until the greasy lines no longer appear. After exposure, the plates are immersed again in the sensitizing bath until the greasy lines disappear.

WASHING PRINTS. The washing of prints after fixation must be thorough to eliminate all trace of the sodium hyposulphite, or the prints will fade. They should be washed in five or six changes of water, separating the prints each time, so that the water may act on all the surfaces; afterwards the prints are left in a pan under running water for several hours. The chief care should be to secure a constant and perfect change of water, and its free access to every part of each print, by which means only can the soda be eliminated. Wooden wash-

ing troughs are to be avoided, as the wood becomes contaminated.

WASHING PRINTS, FAILURES IN. The prints turn yellow in consequence of a number sticking together in the washing. Blistering sometimes occurs when the prints are placed directly from the sodium solution into the washing water. If the fault shows, gradual dilution of the sodium hyposulphite, while the prints are still in it, may remedy the evil. A dark mottled appearance of the print when held up to the light shows that the washing has been imperfect, or that the fixing solution was acid. The exhausted condition of the solution will cause the same fault.

WASTES, REDUCTION OF. 1. All clippings of silvered paper, old filters, paper charged with drippings from silver solutions, &c., should be kept in a suitable box; and when a sufficient quantity has been collected they should be reduced to ashes in the corner of a clean hearth, by having a little square place built up with a few loose bricks. Throw into this place a few handsful, set fire to them, and add the remainder gradually, while keeping up a pretty good fire. When all the waste has been burnt in this way, keep the ashes in a pile, and let them be converted into grey ash. The future success of reduction depends very much on the complete combustion of the waste paper, so that very little charred paper is left, all being reduced to grey ashes, which consist principally of the silica of the paper and partly reduced silver. 2. All the washings of the prints may be collected in a suitable vessel, and the silver precipitated as a chloride by means of common table salt; too much salt should not be added at a time, as the chloride is soluble in a large excess of salt. When a sufficient quantity of chloride of silver has been collected, drain it on a muslin filter and dry it thoroughly. Treat in a similar manner the washing of negatives from the tank. The clear liquid must be drawn off from time to time, by means of a syphon or a tap, placed three or four inches from the bottom. The precipitate consists principally of chloride of silver. 3. The hyposulphite of soda, or fixing solution, should be collected separately in a large tub, and the silver thrown down by keeping a piece of zinc constantly in the liquid; and when the tub gets full of solution the supernatant liquid is poured off. When a suitable quantity has been collected, drain, as the chloride, on a filter, and dry. When perfectly dry, place this waste, which consists of sulphide of silver and metallic silver, in a sand crucible—an old one that has been used for reducing will answer—and expose to the heat of a common stove, merely to expel moisture and sulphur, or, in other words, to roast it. 4. Waste toning or gold solution is more economically collected by pouring it in a shallow dish, and evaporating it to dryness on a stove or in the sun. This consists of the various salts used in toning, generally sodium carbonate and gold chloride, the latter being more or less reduced to a metallic state. The soda will be used as a flux in the operation of reduction. *Reduction.*—The reduction of the wastes to their metallic form is done in a very simple manner, and with perfect success, if the following method be carefully carried out:—A common stove, one with an egg-shaped cylinder, or one having a semi-open fire-place, will answer exceedingly well, if it have a good draught; this latter is essential. The best flux for the various wastes is simply potassium carbonate. A sand crucible of the capacity from a pint to a quart, a pair of tongs, a small scoop with an iron handle—an iron ladle will answer—and a common poker are all the necessary implements. Build up a fresh fire in your stove, introduce the sand crucible, which has been previously filled to the top with an intimate mixture of your waste—either of one kind, or all mixed together—with two or three times its weight of potassium carbonate. Put coal around the crucible as high as the top, and give the stove its full draught.

In the course of one or two hours the contents of the crucible will melt into a liquid mass; you may then add with the scoop more waste, mixed as above with potassium carbonate. This has to be done very gradually, or the gases, set free, will cause the crucible to boil over. In this way a quantity as large as that first introduced into the crucible may be added. When the whole mass assumes a liquid form, try, with a hot poker, whether the mass is homogeneous; if it has tough lumps in it, add cautiously potassium carbonate, keeping up a strong heat; and when the mass becomes uniform, remove the crucible from the fire, taking a firm grip with the tongs, and either pour out the mass into a dry iron vessel, or set the crucible on the front of the stove or on a brick to cool. When cold, you will find the metal in a button, either in the bottom of the crucible, or the inner vessel, as the case may be. The gold waste collected as stated above should be mixed with the other waste, and the soda contained therein will answer as a flux in connection with the potassium carbonate; and the gold mixed with the silver can be separated as directed further on. The process of reduction takes from three to four hours, and a strong white heat must be kept up. The materials must be perfectly dry. No small globules of silver should be found interspersed in the flux. If they are found, it is because the heat was insufficient, or the crucible was removed too soon from the fire. The paper ashes should furnish one-half or three-fourths their weight of metallic silver. One and one-fourth to one and one-half parts of chloride will yield one part of silver, and the other waste from one-half to three-fourths its weight. *Conversion of the Metals into Nitrate of Silver and Chloride of Gold.*—Dissolve the metal in a porcelain dish, in a chimney-place, by adding two and one-half parts of commercial nitric acid to two parts of the silver; use the heat of a very small gas jet or small lamp, placed under the dish. To prevent the projection of liquid from the dish, invert a glass funnel over it, resting just inside the edge of the dish. When the silver is dissolved, remove the funnel, and evaporate the liquid with a stronger heat until dry. It may be used in this state for photographic purposes, or the mass may be dissolved in water, poured off from the back sediment (which consists principally of gold), filter and evaporate again, until a pellicle begins to form on the surface; and then, being removed from the lamp, it is set aside to crystallize into nitrate of silver. The mother liquor may be used in solution, or again evaporated to crystallization. The gold, remaining in black powder, is converted into a chloride by adding to it a small quantity of *aqua regia* (nitric acid one part and muriatic acid three parts) in a glass or porcelain vessel, and evaporating to dryness over a water bath.

WATER, OR HYDROGEN MONOXIDE. H_2O. 17·96. Water is composed of two gaseous elements, oxygen and hydrogen. In the pure state, and at the ordinary temperature, water is transparent, free from taste and smell, and almost colourless. Rain water contains the impurities it has contracted by passing through the atmosphere, carbonic acid, nitric acid, ammonia, hydrocarbons, together with dust, smoke, sulphuric acid, and other constituents of the atmosphere of towns. Spring and river water is still more impure, as it contains the mineral constituents which it has dissolved from the strata from which it has come in contact. Perfectly pure water can only be obtained artificially by distillation; when met with in the natural state it is never pure.

WATER OF CRYSTALLIZATION. Many saline substances, in the act of crystallizing, combine with one or more equivalents of water, the crystalline form varying with the amount so fixed. This water is called water of crystallization or of hydration. The number of equivalents taken up sometimes depends upon the temperature at which the operation is conducted. When this water is so loosely held as to be given off

at an ordinary dry atmosphere, the compound is said to be efflorescent.

WAXED PAPER PROCESSES. *See* CALOTYPE and PAPER NEGATIVES.

WAXING. For the purpose of rendering paper transparent for printing, as in the Calotype process, a metal plate is placed over a vessel of boiling water and heated; on this the paper negative, &c., is laid, and rubbed over with a cake of wax, the heat communicated to the print causing the wax to melt into the paper. The superfluous wax may be melted out before the fire, and the print ironed between sheets of blotting-paper, with a moderately hot iron, until none of the shining patches of wax are left in the paper.

WEIGHTS AND MEASURES. TROY WEIGHT—24 grains = 1 pennyweight; 20 pennyweights = 1 ounce; 12 ounces = 1 pound. AVOIRDUPOIS WEIGHT (Apothecaries' Weight)—27$\frac{11}{32}$ grains = 1 drachm; 16 drachms = 1 ounce; 16 ounces = 1 pound. LIQUID MEASURE—60 minims = 1 drachm; 8 drachms = 1 ounce; 20 ounces = 1 pint; 8 pints = 1 gallon.

WHEY (*A.S*) *See* SERUM.

WOODBURYTYPE. *See* MECHANICAL PROCESSES.

WOOD, PHOTOGRAPHING ON. In sensitizing the block of box wood the great danger is that in absorbing moisture the block will warp. This renders contact with the negative impossible, and spoils the wood for the purpose of engraving. One of the means adopted to obviate this disaster is to prepare from the negative a clear, thin positive, and float off the film in water containing a small percentage of sulphuric acid. From the film all moisture must be pressed; then transfer to the block, which should be previously rubbed over with paste of Chinese white. Another method may be adopted in the use of the "Papyrography" process, *q.v.*, under MECHANICAL PROCESSES. The writer has used bichromated gelatine with which to sensitize the block, and printed thereon direct from the negative. By this process the danger of warping is averted, and a print sufficiently bold for the purpose secured. A blue image may be printed on the block in the following manner. Prepare the surface with gelatine, six grains to the ounce of water, mixed with gilders' white. When dry, brush over it, in the dark room:—No. 1. Red prussiate of potash, 60 grains in 1 ounce of water; No. 2. Ammonia-citrate of iron, 65 grains in 1 ounce of water, mixed when dissolved, and filtered. When this coating is dry, expose the block under the negative in sunshine for ten minutes. Develop by washing the surface with a moist sponge. The resulting picture is of a dark blue colour, and the surface of the block is well adapted for engraving. A red image may be obtained by brushing over the gelatine surface a thirty-grain solution of uranium sulphate in thin gum-arabic or gelatine water. Exposure: fifteen minutes in sunshine. To develop, sponge the surface with clean water, then with another sponge apply a twenty-grain aqueous solution of red prussiate of potash. When the detail is out, wash with the sponge and clean water. If over-printed, a drop of muriatic acid in water will bleach it.

WOOD SPIRIT: METHYL ALCOHOL. $CH_3.OH$. Produced in the dry distillation of wood, forming about one per cent. of the aqueous distillate.

WOTHLYTYPE. A supplementary sizing of arrowroot is given to ordinary photographic paper, and coated with a sensitized collodion prepared as follows:—Plain collodion, 4 ounces; castor oil, 4 drops; canada balsam, 2 drops; ammonio-nitrate of uranium, 160 grains; powdered silver nitrate, 6 grains. The paper is dried in a dark place. Exposed under a negative as in the ordinary printing process. Tone as usual in an alkaline chloride of gold solution. The print should be fixed and thoroughly washed.

WOOLLINESS; an epithet expressing the appearance of prints made on paper from which the albumen has been

dissolved in the sensitizing bath. *See* PRINTING BATH.

YELLOW GLASS. Used for glazing the window of the dark room. Orange yellow is the safest. For some of the dry plate processes yellow glass does not afford sufficient immunity from fog, and in its place is used ruby glass; sometimes two or three thicknesses are placed before the light before freedom is found from fog.

YELLOW PRUSSIATE OF POTASH. *See* POTASSIUM FERRICYANIDE.

ZERO. (*Italian*). Term denoting the point in the thermometer at which the gradation commences.

ZINC. Zn 64·9. An abundant and useful metal, closely resembling magnesium in its chemical character. Zinc is a bluish-white metal, exhibiting crystalline structure; it is brittle at the ordinary temperature. Zinc easily dissolves in dilute acids with evolution of hydrogen, and it is thus used as the oxidizable portion of the galvanic battery.

ZINC BROMIDE. $Zn Br_2$. Formed when bromine vapour is passed over the metal heated to redness. It corresponds closely to the chloride in its properties, and on heating sublimes in the form of white needles.

ZINC CHLORIDE. $Zn Cl_2$. A white or usually greyish white mass, soft like wax, and melting when heated a little above 100°, and subliming at a higher temperature in white needle-shaped crystals.

ZINC IODIDE. $Zn I_2$. Zinc and iodine readily unite when they are heated together, to form a colourless, easily fusible mass which sublimes in four-sided needles. An aqueous solution can be easily obtained by warming metallic zinc and iodine together with water. On evaporating the solution, the anhydrous compound separates out in the form of regular octohedrons, which, when exposed to the air, first absorb water and deliquesce, and then take up oxygen and liberate iodine.

ZINCOGRAPHY. *See* MECHANICAL PROCESSES.

ZINC OXIDE. Zn O. The only known compound of zinc with oxygen: is obtained by burning the metal, or by precipitating a soluble zinc salt with an alkali, and heating the precipitate. Zinc oxide is an insoluble white amorphous powder, which, when heated, becomes yellow, but loses this colour on cooling. It is used as a pigment, and termed zinc white.

Zn. The chemical symbol of Zinc.